

Innovations in Intelligent Computing and Communications

Mrutyunjaya Panda, Harekrishna Misra,
Margarita N. Favorskaya, Anna Esposito *Editors*

Abstract Proceedings of 2nd International Conference on

Innovations in Intelligent
Computing and Communications

ICIICC-2026

August 12-14, 2026

[Theme: Role of AI in Medical Healthcare and Diagnostics]



Utkal University, Bhubaneswar, Odisha

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Utkal University, Bhubaneswar, Odisha, India



Preface

It is with immense pleasure and great pride that I welcome you to the **Second International Conference on Innovations in Intelligent Computing and Communication (ICIICC 2026)**, organized by the **P.G. Department of Computer Science and Applications, Utkal University, Bhubaneswar, India**, during **12–14 August 2026**. The conference, generously sponsored by the **Anusandhan National Research Foundation (ANRF)**, Government of India, has been conceived as an international forum to promote high-quality research, interdisciplinary collaboration, and meaningful dialogue among academicians, researchers, scientists, industry professionals, healthcare experts, and students from across the globe.

The theme of ICIICC 2026, **“Role of AI in Medical Healthcare and Diagnostics,”** reflects the rapidly evolving landscape of intelligent technologies that are transforming healthcare delivery, disease diagnosis, clinical decision-making, biomedical imaging, digital health, and sustainable healthcare systems. Advances in Artificial Intelligence, Machine Learning, Deep Learning, Quantum Computing, Federated Learning, Explainable AI, Internet of Medical Things (IoMT), Edge Intelligence, Digital Twins, and Intelligent Communication Networks are redefining the future of medicine and human well-being. This conference provides a vibrant platform to discuss these emerging developments while encouraging responsible, ethical, and sustainable innovation.

ICIICC 2026 received enthusiastic participation from researchers representing universities, research laboratories, healthcare institutions, and industries in India and abroad. Following a rigorous peer-review process conducted by the Technical Programme Committee and domain experts, high-quality research contributions were selected for presentation and publication. The accepted papers are organized into three thematic sections: **Artificial Intelligence for Medical Diagnostics, AI in Future Healthcare, and Intelligent Computing and Communications**. Together, these contributions demonstrate innovative methodologies, practical applications, and emerging research directions that have the potential to shape the next generation of intelligent healthcare technologies and computational systems.

One of the major highlights of the conference is the distinguished keynote lecture series delivered by internationally renowned researchers and technology leaders. The keynote talks encompass a broad spectrum of contemporary topics, including Agentic AI for healthcare management, AI-native 6G communication networks, cloud and quantum computing, cognitive AI, biosensors and biochips, Vision Transformers for medical imaging, sustainable healthcare systems, multilingual large language models, mobile healthcare architectures, adversarial machine learning, and intelligent biomedical systems. These lectures offer valuable insights into both the theoretical foundations and practical challenges of next-generation intelligent technologies, inspiring researchers to pursue impactful interdisciplinary research.

The success of ICIICC 2026 is the result of the collective efforts of numerous individuals and organizations. I express my sincere gratitude to our Hon’ble Vice-Chancellor, university administration, the General Chair, Program Chairs, Advisory Committee, Technical Programme Committee, keynote speakers, reviewers, session chairs, organizing committee members, volunteers, and every author whose valuable contribution has enriched this conference. I also gratefully acknowledge the generous financial support provided by the **Anusandhan National Research Foundation (ANRF), Government of India**, which has significantly contributed to the successful organization of this international event.

I extend my heartfelt appreciation to **Springer** for providing an excellent platform for disseminating the accepted research contributions through the conference proceedings in its **Advances in Computer Science Applications and Research (ACSAR)** book series. I hope that this volume will serve as a valuable reference for researchers, academicians, industry practitioners, healthcare professionals, and policymakers working in the domains of Artificial Intelligence, Intelligent Computing, Communication Technologies, and Digital Healthcare. More importantly, I hope that the ideas presented in these proceedings will stimulate future collaborations, inspire innovative research, and contribute towards building intelligent, inclusive, secure, and sustainable healthcare ecosystems.

On behalf of the Organizing Committee, I sincerely thank all participants for making ICIICC 2026 a memorable scientific event. I wish every reader an enriching and intellectually rewarding experience with these proceedings and look forward to welcoming you to future editions of the conference.

Prof. Mrutyunjaya Panda

Convenor, ICIICC 2026

Professor & Head

P.G. Department of Computer Science and Applications

Utkal University, Bhubaneswar, Odisha, India

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Mrutyunjaya Panda(India)

Harekrishna Misra (India)

Margarita N. Favorskaya (Russian Federation)

Anna Esposito (Italy)

About Editors

Prof. Mrutyunjaya Panda



Prof. Mrutyunjaya Panda is a Professor in the P.G. Department of Computer Science and Applications, Utkal University, Bhubaneswar, India. He has over two decades of experience in teaching, research, and academic administration. His research interests include Artificial Intelligence, Machine Learning, Explainable AI, Quantum Machine Learning, Intelligent Healthcare Systems, Cybersecurity, Internet of Medical Things (IoMT), Data Analytics, and Intelligent Communication Networks. Prof. Panda has published extensively in reputed international journals, conference proceedings, and edited books, and has successfully supervised numerous doctoral and postgraduate research scholars. He has actively organized international conferences, workshops, and faculty development programmes. He is a member of various professional societies and continues to promote interdisciplinary research, innovation, and international collaboration in emerging areas of intelligent computing and digital healthcare.

Prof. Harekrishna Misra



Prof. Harekrishna Misra, PhD in Information Systems, served as Professor of Information Systems, at Institute of Rural Management Anand (IRMA), Gujarat, currently a School of Tribhuvan Sahakari University (TSU), set up under TSU Act and Ministry of Cooperation, GoI. He was Chair Professor, Verghese Kurien Centre of Excellence of IRMA. He also served as the Chairperson of the advisory committee of the Entrepreneurship Board of DST, GoI (iSTED). He was a member in the Governing Council of National Council of Cooperative Training (NCCT). He also was a member of the drafting committee of National Cooperation Policy-2025 and Odisha State Cooperation Policy-2026.

He has around 43 years of experience in industry and academia in the fields of IT infrastructure management, database management, communication systems and networks. He closely works in the area of rural e-governance and associated metrics-based measurements for readiness in connected services, and digital transformation in rural enterprises. His research interests include AI and ML, Industry 4.0 and beyond, Healthcare Informatics, and ICT for Sustainable Development.

He is currently Vice-Chairman, Research Committee, of the International Cooperative Alliance – Asia Pacific (ICA-AP). He serves on the Board of Sahaj Retail Limited, Kolkata, India that deals with e-governance supported digital services in rural areas in India. He is a Category Editor for the Computing Reviews – ACM, USA. He is an associate editor of International Journal of System Assurance Engineering and Management-Springer Nature.

Dr. Margarita N. Favorskaya



Dr. Margarita N. Favorskaya is a Professor and Head of Department of Informatics and Computer Techniques at Reshetnev Siberian State University of Science and Technology., Russian Federation.

Professor Favorskaya is a member of KES International since 2010, the IPC member and the Chair of invited sessions of over 30 international conferences. She serves as an associate editor of many international journals including Intelligent Decision Technologies Journal, International Journal of Knowledge-Based and Intelligent Engineering Systems, She is the author or the co-author of 200 publications and 20 educational manuals in computer science. She co-edited/co-authored 50+ books for Springer.

Her main research interests are in the theory and applications of artificial intelligence and information technologies.

Prof. Dr. Anna Esposito



Prof. Dr. Anna Esposito, received her "Laurea Degree" summa cum laude in Information Technology and Computer Science from University of Salerno in 1989. She received her PhD Degree in Applied Mathematics and Computer Science from University of Napoli "Federico II" in 1995. Her PhD thesis on: Vowel Height and Consonantal Voicing Effects: Data from Italian (published on *Phonetica*, vol 59(4),197-231, 2002) was developed at Massachusetts Institute of Technology (MIT), Research Laboratory of Electronics (RLE), under the supervision of Professor Kenneth N Stevens.

She has been Post Doc at the International Institute for Advanced Scientific Studies (IIASS), Assistant Professor at the Department of Physics at the University of Salerno (Italy), and Research Professor (2000-2002) at the Department of Computer Science and Engineering at Wright State University (WSU), Dayton, OH, USA. Anna is currently Full Professor in Artificial Intelligence and Multimodal Communication at the Department of Psychology of the University of Campania "Luigi Vanvitelli", Italy. Her teaching responsibilities include Fundamentals of Artificial Intelligence, Multimodal Communication, Human Machine Interaction, Cognitive Economy, and Decision Making. She authored 320+ peer reviewed publications in international journals, books, and conference proceedings, edited/co-edited 33+ books/conference proceedings and guest edited several special issues, among those the International Journal on Artificial Intelligence Tools (IJAIT, 2017), and Cognitive Computation (2014, 2012). Anna has been the Italian Management Committee Member of several ESF COST Actions among those COST 277 on Nonlinear Speech Processing, <https://www.cost.eu/actions/277> and COST TD0904 on Time in Mental Activity, <https://www.cost.eu/actions/TD0904/>. Additionally, she has been CHAIR AND PROPOSER of COST 2102 on Cross Modal Analysis of Verbal and Nonverbal Communication, <https://www.cost.eu/actions/2102/>.

Since 2006, she is a Member of the European Network for the Advancement of Artificial Cognitive Systems, Interaction and Robotics (www.eucognition.org).

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Emesys Software Solutions Pvt Limited, Bangalore

Prof. Aniket Mahanti

University of Auckland, New Zealand

Dr. Hemant Kumar Rath

TCS Research, Bhubaneswar

Prof. Nilanjan Dey

Techno India International, Kolkata

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Prof. Raj Kumar Buyya

University of Melbourne, Australia

Prof. S. Nagini

VNR Vignana Jyothi Institute of Engineering & Technology, Hyderabad

Prof. Saroj Kumar Meher

Indian Statistical Insitute, Bangalore

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Messages



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Prof. Chandi Prasad Nanda
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MESSAGE FROM THE VICE-CHANCELLOR

It gives me immense pleasure to extend my warm greetings to the Convener, Organising Committee, faculty members, researchers, students and participants of the 2nd International Conference organised by the Department of Computer Science and Applications, Utkal University.

We are living through a moment when Computer Science is acquiring a meaning far larger than computation itself. Artificial Intelligence, intelligent systems, brain mapping, digital diagnostics and emerging interfaces between technology and healthcare are not merely extending the frontiers of scientific possibility; they are transforming the ways in which we understand knowledge, intelligence, the human body and, increasingly, the organisation of everyday life.

The themes of this Conference therefore occupy an important intellectual frontier. They bring computation into conversation with cognition, medicine, communication, ethics and sustainability. At the same time, they invite us to confront a question that must accompany every technological breakthrough: not simply what technology can do, but what kind of human and institutional future we want technology to help create.

This question has particular significance for Utkal University at the present moment. As we articulate a larger transformative vision for the University through our emerging **White Paper**, the idea of a **Digital Utkal** is being imagined as an integral part of a new institutional horizon. Digital transformation, in this conception, cannot remain confined to automation, connectivity or the migration of existing practices onto technological platforms. Its deeper promise lies in changing the very ecology through which a university learns, researches, governs, communicates and engages with society.

The aspiration is to gradually transform the campus into a **living knowledge ecology**—one in which technology converses with institutional practice, laboratories with landscapes, data with lived experience, and innovation with the social and ecological worlds within which the University is located. A digitally enabled campus must therefore also become an intelligent, responsive and reflexive campus: capable of connecting classrooms, laboratories, libraries, administrative systems and the physical environment into a more integrated architecture of knowledge.

Seen from this perspective, the present Conference acquires a significance beyond its immediate disciplinary deliberations. I see it as an opportunity to **ignite the imagination of Digital Utkal**. The Department of Computer Science and Applications can become an important intellectual and technological interlocutor in this journey—not simply by developing technologies, but by helping the University ask how technology might reshape learning, research cultures, institutional processes and our relationship with the campus itself.

For the university of the future, the laboratory cannot remain detached from the land on which it stands; nor can technology remain external to institutional life. The real transformative



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possibility emerges when the **laboratory, the landscape and institutional practice begin to speak to one another**—when digital intelligence enables us to understand our energy, water,

mobility, biodiversity, learning environments and governance systems as interconnected dimensions of a single knowledge ecology.

I am particularly pleased that the proceedings of the Conference are being developed as a research database. Such an initiative gives the deliberations an intellectual afterlife, allowing ideas generated during the Conference to travel further, generate new questions and encourage future collaborations.

I congratulate the Department of Computer Science and Applications for creating this timely platform and wish the Conference every success.

May the conversations initiated here help us move from digital infrastructure to digital imagination; from computation to knowledge; and from technological capability to an ecology in which intelligence, responsibility and life can flourish together.

(Professor Chandi Prasad Nanda)
Vice-Chancellor
Utkal University



BIJU PATNAIK UNIVERSITY OF TECHNOLOGY, ODISHA, ROURKELA
(An Affiliating State University of Govt. of Odisha)

Prof. Amiya Kumar Rath
Vice Chancellor

MESSAGE

It gives me immense pleasure to know that the PG Department of Computer Science and Applications of Utkal University, Bhubaneswar is organising the 2nd International Conference on Innovations in Intelligent Computing and Communications (ICIICC-2026) from 12th to 14th August 2026.

Intelligent Computing is the driving force behind today's digital transformation, enabling smarter decision-making, seamless connectivity, and innovative solutions for a sustainable and technology-driven future.

I encourage all participants to actively engage in the technical sessions, keynote lectures, panel discussions, and networking opportunities. I wish the Conference a great success and hope that all participants have a productive, enriching, and memorable experience.

Amiya Kumar Rath
Vice Chancellor 06/08/2026.



ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH
BHUBANESWAR

Prof. Bibhuti Bhusan Biswal
Vice Chancellor

Message

It gives me immense pleasure to extend my warm greetings and best wishes to all the distinguished keynote speakers, eminent researchers, academicians, industry experts, scholars, students, and delegates on the eve of the 2nd International Conference on Innovations in Intelligent Computing and Communications (ICIICC-2026) being organized by Utkal University, Bhubaneswar. The Conference provides an important platform for the exchange of ideas, research findings, technological innovations, and professional experiences in the rapidly evolving fields of intelligent computing and communication. The conference reflects Utkal University's enduring commitment to academic excellence, interdisciplinary research, innovation, and the responsible application of knowledge for the benefit of society.

We are living in an era where intelligent computing, artificial intelligence, machine learning, data science, cloud computing, cybersecurity, the Internet of Things, quantum technologies. Advanced communication systems are transforming every aspect of human life. The rapid convergence of these technologies is redefining industries, enhancing governance, revolutionizing healthcare and education, and creating unprecedented opportunities for sustainable development. At the same time, it presents new challenges that demand collaborative research, ethical innovation, and interdisciplinary thinking. I am confident that the technical sessions, keynote lectures, invited talks, panel discussions, and paper presentations will provide participants with valuable insights. I sincerely hope that every participant will make the most of this opportunity to engage in stimulating discussions, establish professional networks, explore collaborative research avenues, and contribute to the advancement of science and technology.

I particularly welcome the young researchers and students participating in this conference. Their curiosity, creativity, and willingness to explore new ideas are essential to the future of science and technology. I encourage them to use this occasion not only to present their work, but also to listen, question, learn, and build lasting academic and professional connections.

I take this opportunity to congratulate the organizing committee, the advisory board, the technical program committee, reviewers, volunteers, sponsors, and all those who have worked tirelessly to make this prestigious international event a reality. Their dedication, meticulous planning, and unwavering commitment deserve heartfelt appreciation.

I extend my best wishes for the grand success of the 2nd International Conference on Innovations in Intelligent Computing and Communications (ICIICC-2026). May the conference be marked by insightful discussions, inspiring presentations, productive interactions, and new pathways of discovery. May your time here be intellectually enriching, professionally rewarding, and personally memorable.

With warm greetings and best wishes to all participants.

Prof. Bibhuti Bhusan Biswal

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Chairperson, PG Council



Message from the Chairperson, Post Graduate Council

It gives me immense pleasure to extend my warm greetings and best wishes on the occasion of the 2nd International Conference on Innovations in Intelligent Computing and Communication (ICIIC-2026), being organized by the Department of Computer Science, Utkal University, from 12–14 August 2026.

The conference theme, "AI in Medical Healthcare and Diagnostics," is both timely and significant. Artificial Intelligence has emerged as a transformative force in modern healthcare, enabling advancements in disease diagnosis, personalized treatment, predictive analytics, medical imaging, and healthcare management. Bringing together researchers, academicians, industry experts, healthcare professionals, and students, this conference will provide an excellent platform to exchange innovative ideas, present cutting-edge research, and foster interdisciplinary collaborations that address real-world healthcare challenges.

I am confident that the deliberations and technical sessions during the conference will inspire meaningful discussions and pave the way for future innovations in intelligent computing and communication technologies for the betterment of society.

I congratulate the organizing committee, faculty members, research scholars, and students of the Department of Computer Science for their dedicated efforts in organizing this prestigious international event. I also extend a cordial welcome to all the delegates and participants from across the globe and wish them a fruitful and enriching academic experience.

I wish the conference for a great success.

Prof. Jagneshwar Dandapat
Chairperson, Post Graduate Council
Utkal University, Bhubaneswar

Prof. Aurobinda Routray

It is my great pleasure to welcome you to the 2nd International Conference on Innovations in Intelligent Computing and Communications (ICIICC 2026). As artificial intelligence reshapes every facet of modern society, its transformative impact on medical diagnostics, personalized healthcare, and intelligent clinical decision support has emerged as one of the most exciting frontiers of scientific research. ICIICC 2026 is envisioned as a global platform where researchers, clinicians, engineers, entrepreneurs, and policymakers come together to explore how intelligent computing can revolutionize healthcare while addressing broader challenges in communication technologies and intelligent systems.

Over the past two decades, my research has focused on translating advances in signal processing, embedded intelligence, machine learning, computer vision, and intelligent sensing into practical healthcare solutions. From AI-assisted medical diagnostics and biomedical signal analysis to wearable health monitoring and predictive healthcare systems, I have witnessed how interdisciplinary research can bridge the gap between laboratory innovation and societal impact. The future of healthcare will increasingly depend on intelligent algorithms that are not only accurate and explainable but also accessible, affordable, and trustworthy.

ICIICC 2026 seeks to foster this vision by bringing together leading experts from academia, industry, healthcare institutions, and government organizations to discuss the latest advances in AI-driven diagnostics, medical imaging, biomedical signal processing, digital health, intelligent communication systems, and next-generation computing technologies. Beyond technological innovation, the conference aims to encourage discussions on ethical AI, data privacy, clinical validation, and responsible deployment of intelligent healthcare systems.

I warmly invite researchers, innovators, healthcare professionals, and young scholars from across the world to contribute their best work and actively engage in this vibrant exchange of ideas. Together, let us advance the frontiers of intelligent computing and communication technologies to build a future where artificial intelligence enhances healthcare delivery, improves patient outcomes, and contributes meaningfully to the well-being of society.

I look forward to welcoming you to Bhubaneswar for an intellectually stimulating, collaborative, and memorable ICIICC 2026.

Prof. Aurobinda Routray

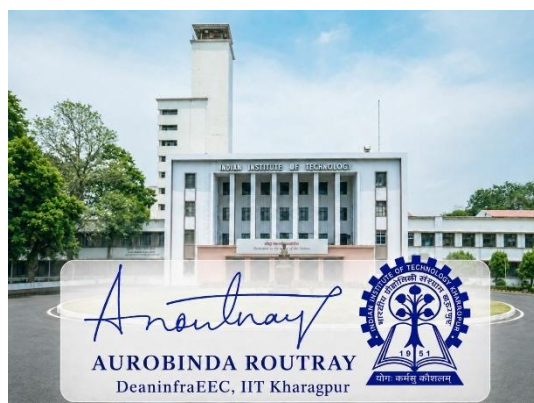
General Chair, ICIICC 2026

Professor, Department of Electrical Engineering

Dean (Infrastructure – Electrical, Electronics & Computing)

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Prof. Harekrishna Misra



I am happy that we are able to present before you the second edition of the International Conference on Innovations in Intelligent Computing and Communications, ICIICC- 2026. As part of the programme committee, it is indeed my pleasure and privilege to share my thoughts. The second edition of the conference series with theme “Role of AI in Medical Healthcare and Diagnostics” is being held at an appropriate time when the emerging role of artificial intelligence (AI) is pervasive. AI shall continue to influence social, ecological, personal, natural and emotional cornerstones of our life. We also

continue to experience the digital transformation effects through innovation and adoption policies and strategies of governments at all levels, especially public health and associated logistics. Health is an important dimension of our quality of life and AI has the scope for establishing protocols for diagnosis and discovering areas of improvements in preventive healthcare. AI also can increasingly influence the way we live and work, the way research and disease surveillance are conducted. AI driven healthcare protocols, processes, logistics, devices, services and expertise will hold the promise for our future life. This conference brings along the overarching and interdisciplinary dimensions of research, practices and use cases with contributions from academia, researchers, practitioners, policy makers and emerging scholars. I hope this conference shall be the bedrock of intense discussions, deliberations and engagements in finding ways to use AI in diagnostics and healthcare and find ways to use AI as a tool that respects ethics, emotion and privacy of patients, sustainable use of associated technologies with continuous innovation, quality and integrity. I am confident the deliberations also would chart pathways to instil good governance for AI deployment across sectors with normative approaches to benefit health systems for humans and livestock with associated food value-chains and to enforce strategies for equitable rural-urban health services. I sincerely hope, AI shall be used an agent with ethical governance of datasets for the health sector.

I wish the conference a grand success.

Prof. Harekrishna Misra
Program Co-Chair, ICIICC-2026



Professor & Head, P.G. Department of Computer Science and Applications



It gives me immense pleasure to welcome all distinguished delegates, keynote speakers, researchers, academicians, industry professionals, and students to the Second International Conference on Innovations in Intelligent Computing and Communication (ICIICC 2026), organized by the P.G. Department of Computer Science and Applications, Utkal University, Bhubaneswar, India, during 12–14 August 2026. Sponsored by the Anusandhan National Research Foundation (ANRF), Government of India, the conference has been organized with the objective of fostering collaboration among researchers and practitioners working in the rapidly evolving domains of Artificial Intelligence, Intelligent Computing, Communication Technologies, and their transformative applications in healthcare and medical diagnostics.

The central theme of ICIICC 2026, “Role of AI in Medical Healthcare and Diagnostics,” reflects the growing importance of intelligent technologies in addressing contemporary healthcare challenges. The conference provides an interdisciplinary platform for presenting innovative research on Artificial Intelligence, Machine Learning, Explainable AI, Quantum Computing, Digital Health, Internet of Medical Things (IoMT), Federated Learning, Medical Imaging, Bioinformatics, Intelligent Communication Systems, and other emerging technologies that are shaping the future of healthcare and society.

The response to this conference has been truly encouraging. We received 150 full-paper submissions through the EasyChair Conference Management System from researchers representing universities, research laboratories, healthcare institutions, and industries across India and several other countries. Each manuscript underwent a rigorous double-blind peer-review process conducted by experts from the Technical Programme Committee and external reviewers, with emphasis on originality, technical quality, scientific contribution, methodological rigor, and relevance to the conference theme. After a comprehensive evaluation process, only 27% of the submitted manuscripts were accepted for presentation at the conference and publication in the Springer ACSAR Book Series, reflecting the high academic standards and selectivity maintained by ICIICC 2026.

The accepted papers cover a broad spectrum of emerging research areas and have been organized into three thematic tracks: Artificial Intelligence for Medical Diagnostics, AI in Future Healthcare, and Intelligent Computing and Communications. In addition, the conference features an outstanding lineup of keynote lectures delivered by internationally renowned researchers and industry leaders, providing valuable insights into cutting-edge developments in intelligent healthcare systems, AI-native communication networks, quantum computing, cognitive intelligence, digital health, and sustainable technologies.

The successful organization of ICIICC 2026 has been possible through the collective dedication and unwavering support of many individuals and organizations. I express my sincere gratitude to our Hon’ble Vice-Chancellor, the university administration, the General Chair, Program Chairs, Advisory Committee, Technical Programme Committee, keynote speakers, reviewers, session chairs, organizing committee members, volunteers, authors, and participants for their invaluable contributions. I also gratefully acknowledge the financial

support extended by the Anusandhan National Research Foundation (ANRF), Government of India, which has significantly strengthened the organization of this international event.

I extend my heartfelt appreciation to Springer Nature for publishing the accepted papers in the ACSAR Book Series, thereby ensuring the global dissemination and visibility of the research presented at this conference. I am confident that these proceedings will serve as a valuable reference for researchers, educators, industry practitioners, and policymakers, while inspiring new collaborations and innovative research addressing real-world challenges through intelligent computing and communication technologies.

On behalf of the Organizing Committee, I thank all contributors for making ICIICC 2026 a grand success. I hope the scientific discussions initiated during this conference will continue to inspire impactful research, foster international collaborations, and contribute meaningfully to the advancement of intelligent technologies for the benefit of society.



Prof. Mrutyunjaya Panda
Convenor, ICIICC 2026

Professor & Head
P.G. Department of Computer Science and Applications
Utkal University, Bhubaneswar, Odisha, India

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KNA-1: Agentic AI in Healthcare Management

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Abstract

Healthcare systems worldwide are under mounting pressure from rising patient volumes, growing administrative burden, and fragmented care coordination. Agentic Artificial Intelligence, defined as AI systems capable of autonomous perception, reasoning, planning, and action within defined constraints, offers a transformative pathway for healthcare management by shifting from passive analytics toward proactive, goal-directed intervention. Unlike conventional rule-based or single-task AI tools, agentic systems perceive dynamic clinical environments, reason over multimodal data streams, plan multi-step actions, and execute or recommend interventions with minimal human oversight, while remaining accountable through human-in-the-loop governance, ensuring that autonomy is exercised within clearly bounded clinical and operational limits.

A conceptual architecture is proposed spanning four layers: perception agents that ingest data from electronic health records, wearables, and laboratory systems; reasoning agents that support clinical decision-making and risk stratification; planning agents that orchestrate care pathways; and execution agents that automate tasks, alerts, and follow-up scheduling. These layers operate under a supervisory framework that enforces clinical safety, regulatory compliance, and ethical constraints across patient triage and scheduling, clinical documentation, care coordination, revenue cycle management, medication adherence monitoring, and chronic disease management.

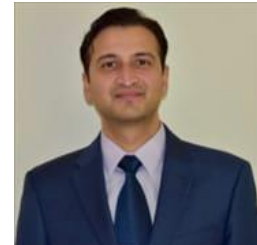
Emerging implementations and a simulation framework illustrate how such multi-agent systems can reduce administrative overhead, shorten care coordination cycles, improve early detection of patient deterioration, and personalize treatment plans at scale. Evaluation metrics including decision latency, diagnostic concordance with clinician judgment, workflow efficiency gains, and patient safety incident rates are introduced to benchmark agentic AI performance against conventional clinical workflows, providing a quantitative basis for comparing autonomous and human-led processes.

Several critical challenges accompany this shift: explainability and auditability of autonomous decisions, liability when agents act semi-independently, safeguarding patient data privacy under HIPAA and comparable regulations, mitigating algorithmic bias across diverse patient populations, and sustaining clinician trust through transparent human-AI collaboration models.

Agentic AI represents a meaningful evolution in healthcare management, capable of moving institutions from reactive toward predictive and preventive care, provided this potential is realized through robust governance, interoperability standards, and continuous human oversight. The proposed framework offers healthcare organizations and technologists a structured foundation for designing, deploying, and evaluating agentic AI systems that enhance operational efficiency while preserving clinical safety and patient trust.

KNA-2: Web3 vs Fediverse: A comparative analysis of DeSo and Mastodon as decentralised social media ecosystems

Prof. Aniket Mahanti
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Abstract

The rise of centralised social networks has consolidated power among a few major technology companies, raising critical concerns about privacy, censorship, and transparency. In response, decentralised alternatives, including Web3 platforms like Decentralised Social (DeSo) and Fediverse platforms such as Mastodon, have gained increasing attention. While prior research has explored individual aspects of decentralised networks, comparisons between Fediverse and Web3 platforms remain limited, and the unique dynamics of Web3 networks like DeSo are not well understood. This study provides the first in-depth study of DeSo, characterising user behaviour, discourse, and economic activities, and compares these with Mastodon and memo.cash. We collected over 3.1M posts from 13K users on DeSo and Mastodon, along with 11M DeSo on-chain transactions via public APIs. Our analysis reveals that while DeSo and Mastodon share similarities in passive content engagement, they differ in their use of URLs, hashtags, and community focus. DeSo is primarily oriented around Decentralised Finance (DeFi) topics, whereas Mastodon hosts diverse discussions with an emphasis on news and politics. Despite DeSo's decentralised social graph, its transaction graph remains centralised, underscoring the need for further decentralisation in Web3 platforms. Additionally, while wealth inequality exists on DeSo, low transaction fees promote user participation irrespective of financial status. These findings provide new insights into the evolving landscape of decentralised social networks and highlight critical areas for future research and platform development.

KNA-3: Moving Towards 6G - Transformation and Realization with AI

Dr. Hemant Kumar Rath

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Abstract

The evolution from 5G to 6G represents much more than an incremental increase in network speed and capacity; it marks a paradigm shift toward intelligent, autonomous, and highly adaptive communication systems. As emerging applications such as Immersive Extended Reality (XR), Digital Twins, Holographic Communications, Industrial Automation, Internet of Everything (IoE), and Autonomous Mobility demand unprecedented levels of connectivity, reliability, security, and sustainability, 6G is expected to become an AI-native ecosystem where intelligence is embedded throughout the network fabric.

This talk explores the technological transformation driving the journey toward 6G, covering the evolution of network architectures, key enabling technologies, and operational paradigms. It highlights the convergence of artificial intelligence, edge and cloud computing, integrated sensing and communication, quantum technologies, Reconfigurable Intelligent Surfaces (RIS), blockchain, and advanced wireless communication techniques that collectively enable next-generation digital services. Particular emphasis is placed on the role of AI in realizing autonomous networks through prediction, prescription, optimization, closed-loop automation, intent-driven operations, and enhanced security.

The presentation also discusses practical challenges associated with 6G deployment, including scalability, data management, privacy, trustworthiness, sustainability, and multi-domain orchestration. Finally, the talk addresses the growing importance of Sustainable AI in future networks, emphasizing energy-efficient architectures, intelligent resource utilization, and responsible deployment of AI technologies. By connecting ongoing advancements in communications, computing, and artificial intelligence, the talk provides a holistic perspective on how AI can serve as the foundational enabler for transforming the vision of 6G into reality and unlocking new opportunities for industry, enterprises, and society.

KNA-4: The bigger, the better?

Prof. Nilanjan Dey

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visiting fellow of the University of Reading, UK

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Abstract

The rapid growth of data and artificial intelligence has reinforced the popular belief that bigger datasets inevitably lead to better machine learning models. This talk critically examines that assumption by exploring the relationship between data volume, data quality, model complexity, and real-world performance. Drawing on examples from ImageNet, deep learning, large language models, and healthcare applications, the presentation highlights challenges such as dark data, data pollution, garbage-in-garbage-out effects, overfitting, dataset bias, limited annotated data, and model robustness. Particular attention is given to practical issues including data labeling costs, small-data learning, synthetic data generation, transfer learning, data augmentation, explainable AI, and the environmental impact of large-scale AI systems. Through a series of thought-provoking questions and case studies, the talk argues that success in AI depends not merely on “big data,” but on clean, diverse, representative, and trustworthy data. The discussion ultimately addresses whether bigger is always better—or whether smarter data is the true driver of intelligent systems.

KNA-5: AI in Health: Inferences for next Generation AI System

Prof. Tapan K. Gandhi

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and AIIMS New Delhi.

Professor, Dept. of Electrical Engineering, Cadence Chair Professor
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Abstract:

Artificial Intelligence (AI) is rapidly transforming healthcare through advances in medical imaging, disease prediction, and patient monitoring. However, most existing AI systems remain largely data driven, excelling at pattern recognition but lacking a deeper understanding of human health. This limits their ability to generalize, adapt, and provide clinically meaningful insights.

My talk will unfold a paradigm shift: using healthcare not just as an application domain, but as a foundation for designing next generation AI systems. By learning from human biology, brain function, and behaviour, we can develop AI that is more adaptive, interpretable, and aligned with real world clinical needs. Integrating multimodal data; such as brain imaging, eye movements, and physiological signals, enables richer representations of health and disease.

I will highlight our work in brain inspired AI and digital health, where models move beyond static predictions toward understanding the scientific basis of biology for the robust AI model development. These approaches emphasize explainability and human centric design.

The future lies in closing the loop between data, understanding, and system design; enabling AI that not only detects disease but understands health, paving the way for more resilient, personalized, and preventive healthcare.

KNA-6: AI-Driven Holistic Health Monitoring Framework for Continuous Health Improvement Using Artificial Immune Systems

Prof. S. Viswanadha Raju

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Abstract

The global rise in lifestyle-related disorders and chronic diseases has intensified the need for intelligent healthcare systems that shift the focus from reactive treatment to continuous health monitoring, preventive healthcare, and holistic well-being. Modern human health is shaped by a combination of physiological, behavioural, environmental, digital, and psychosocial factors, including sleep quality, nutrition, hydration, physical activity, sedentary behaviour, screen time and digital device usage, stress, work–life balance, financial wellness, mental well-being, cardiovascular health, environmental exposure, and social connectedness. Continuous assessment and optimization of these interconnected lifestyle factors are essential for strengthening immunity, reducing disease risk, and improving long-term health outcomes. An Artificial Intelligence (AI)-driven Holistic Health Monitoring Framework is presented by integrating Artificial Immune Systems (AIS), Machine Learning (ML), the Internet of Things (IoT), wearable sensors, and intelligent health analytics to enable continuous lifestyle assessment, immunity evaluation, early disease prediction, and personalized preventive healthcare. The framework introduces a mathematical Immunity Index (II) that quantifies an individual's overall health status by integrating multidimensional lifestyle and physiological parameters. Inspired by the adaptive behaviour of the human immune system, it employs the Negative Selection Algorithm (NSA) to detect abnormal health conditions, the Clonal Selection Algorithm (CSA) to improve prediction accuracy through adaptive learning and immune memory, and Artificial Immune Networks (AINs) to model the complex interactions among health determinants for intelligent decision support.

Unlike conventional healthcare systems that primarily focus on diagnosis after disease onset, the framework incorporates a Continuous Health Improvement (CHI) cycle comprising monitoring, assessment, prediction, personalized intervention, outcome evaluation, and continuous feedback. This closed-loop approach enables adaptive health management, promotes sustainable lifestyle modifications, and supports evidence-based clinical decision-making. Continuous data acquisition from wearable sensors and IoT devices facilitates real-time health monitoring, anomaly detection, personalized wellness recommendations, and dynamic health risk assessment. The AI–AIS framework is designed for validation using publicly available healthcare datasets and wearable sensor data and is evaluated using standard healthcare and machine learning performance metrics. Comparative analysis with conventional machine learning approaches is expected to demonstrate improvements in anomaly detection, prediction accuracy, adaptability, explainability, and personalized healthcare recommendations. Overall, the framework provides a scalable, adaptive, explainable, and data-driven architecture for holistic health monitoring and continuous health improvement. By integrating Artificial Intelligence, Artificial Immune Systems, Nature-Inspired Computing, IoT-enabled sensing, and predictive health analytics, it advances the development of next-generation intelligent healthcare systems that strengthen immunity, promote preventive healthcare, improve quality of life, and support sustainable, patient-centred clinical decision-making.

KNA-7: Neoteric Frontiers in Cloud and Quantum Computing

Prof. Rajkumar Buyya

Fellow of ACM, IEEE, and Academia Europaea
Director, Cloud Computing and Distributed Systems (CLOUDS)
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Abstract

The twenty-first-century digital infrastructure and applications are driven by Cloud computing, Internet of Things (IoT), Artificial Intelligence (AI), and Quantum computing paradigms. The Cloud computing paradigm has been transforming computing into the 5th utility wherein "computing utilities" are commoditized and delivered to consumers like traditional utilities such as water, electricity, gas, and telephony. It offers infrastructure, platform, and software as services, which are made available to consumers as subscription-oriented services on a pay-as-you-go basis over the Internet. Its use is growing exponentially with the continued development of new classes of applications such as AI-powered models (e.g., ChatGPT) and the mining of crypto currencies such as Bitcoins. To make Clouds pervasive, Cloud application platforms need to offer (1) APIs and tools for rapid creation of scalable and elastic applications and (2) a runtime system for deployment of applications on geographically distributed Data Centre infrastructures (with Quantum computing nodes) in a seamless manner.

This keynote presentation will cover (a) 21st century vision of computing and identifies various emerging IT paradigms that make it easy to realize the vision of computing utilities; (b) innovative architecture

for creating elastic Clouds integrating edge resources and managed Clouds, (c) Aneka 6G, a 6th generation Cloud Application Platform, for rapid development of Big Data/AI applications and their deployment on private/public Clouds driven by user requirements, (d) experimental results on deploying Big Data/IoT applications in engineering, health care (e.g., COVID-19), deep learning/Artificial intelligence (AI), satellite image processing, and natural language processing (mining COVID-19 literature for new insights) on elastic Clouds, (e) QFaaS: A Serverless Function-as-a-Service Framework for Quantum Computing; and iQuantum Simulation Toolkit, and (f) new directions for emerging research in Cloud and Quantum computing.

KNA-8: Human Cognition to Clinical Intelligence: Cognitive AI in Healthcare

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Abstract

Human Cognition to Clinical Intelligence: Cognitive AI in Healthcare Artificial Intelligence (AI) has rapidly evolved from a pattern recognition technology to an intelligent clinical assistant capable of supporting healthcare professionals across diagnosis, treatment planning, and patient management. As healthcare systems face increasing patient volumes, clinician shortages, and growing diagnostic complexity, there is a pressing need for AI systems that are not only accurate but also transparent, explainable, and clinically trustworthy. The transition from traditional AI to Cognitive AI is explored, highlighting a paradigm inspired by human cognitive processes such as perception, attention, memory, reasoning, decision-making, and metacognition. The integration of Cognitive AI with knowledge representation techniques, including medical ontologies, knowledge graphs, and semantic reasoning, enables context-aware clinical decision support. It highlights how the convergence of machine learning, deep learning, symbolic reasoning, and explainable AI (XAI) can transform medical diagnostics by improving transparency, interpretability, and clinician confidence. Applications across radiology, pathology, dermatology, genomics, electronic health records, and multimodal clinical intelligence are presented to demonstrate the broad impact of Cognitive AI on modern healthcare.

A dedicated case study on AI-assisted skin cancer diagnosis illustrates how cognitive principles translate into real-world clinical workflows, emphasizing explainable decision support through image analysis, confidence estimation, and human validation. The presentation further addresses emerging trends such as multimodal foundation models, neuro-symbolic AI, digital twins, federated learning, and precision medicine, while discussing critical challenges related to data quality, bias, privacy, ethics, regulatory compliance, and responsible AI deployment. The central message is that the future of healthcare lies not in replacing clinicians with intelligent machines but in fostering Human–AI collaboration, where Cognitive AI augments clinical expertise with rapid analysis, knowledge-driven reasoning, and explainable recommendations. By combining human intelligence with artificial intelligence, Cognitive AI paves the way toward safer, smarter, and more personalized healthcare, ultimately transforming clinical intelligence and improving patient outcomes

KNA-9: Adversarial Machine Learning: A Technical Overview

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Abstract:

Adversarial Machine Learning is an emerging research area that focuses on security, robustness, and reliability of machine learning algorithms under deliberately crafted malicious inputs. Modern machine learning techniques, particularly deep neural networks, have been highly successful in numerous applications, including computer vision, autonomous systems, healthcare, and cybersecurity. However, to a great extent, they are vulnerable to adversarial attacks that add carefully designed perturbations to cause incorrect predictions while remaining almost imperceptible to humans. These vulnerabilities pose major challenges to deploying machine learning systems in safety- and security-critical domains.

In this technical overview, we discuss the basic ideas, taxonomy, and methods of adversarial machine learning. It discusses the threat model, considering the attacker's goals, knowledge, and capabilities, and classifies adversarial attacks into poisoning, evasion, model extraction, membership inference, and backdoor attacks. The overview also distinguishes among white, grey, and black-box attack scenarios. It summarises the most common attack algorithms, e.g., Fast Gradient Sign Method (FGSM), Projected Gradient Descent (PGD), Carlini-Wagner (C&W), DeepFool, and adversarial patch attacks. The study reviews the state of the art defense mechanisms, including adversarial training, defensive distillation, input pre-processing, robustness, randomized smoothing, and anomaly detection. We also emphasize their strengths, limitations, and trade-offs between robustness, computational complexity, and model accuracy.

Finally, we survey challenges of current research studies, including adaptive adversaries, attack transferability, robustness evaluation, explainability, and security deployment of conventional artificial intelligence systems. The aim of the overview is to provide researchers, practitioners, and students with the tools to understand current threats, assess defense strategies, and identify promising approaches for building robust, trustworthy, and resilient machine learning systems that reliably operate in adversarial environments.

KNA-10: Biosensors and Biochips Empowered by Machine Learning: Towards Intelligent Healthcare Systems

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Abstract:

The fast advancement of biosensor and biochip technologies has transformed modern healthcare by enabling sensitive, swift, and decentralized detection of disease biomarkers. Electrochemical and SERS biosensors are advanced sensing platforms suitable for point-of-care diagnostics due to their high sensitivity, specificity, rapid response, and clinical potential. Electrochemical biosensors use electrical signals for measurements, while SERS biosensors offer molecular fingerprints for detecting trace biomarkers. Unfortunately, despite the promise of both biosensors for broader applications in clinical settings, clinical implementation will be hindered by factors such as variability in signal responses, difficult-to-analyze mixed biological samples, challenges with multiplexing, and difficulties in processing complex data. Recent developments in machine learning (ML) have enabled transformative solutions by automating signal preprocessing, feature extraction, spectral analysis, pattern recognition, biomarker classification, and predictive diagnostics. The integration of machine learning algorithms with electrochemical and surface-enhanced Raman spectroscopy (SERS) biosensors leads to increased analytical accuracy, greater immunity to noise, the ability to detect multiple biomarkers simultaneously, and the ability to assist doctors in making immediate clinical decisions. Additionally, combined efforts of intelligent biochips, microfluidic devices, wearable biosensors, the Internet of Medical Things (IoMT), and cloud-based analytics are accelerating the development of fully autonomous diagnostic systems designed to provide personalized healthcare services.

This research reviews the latest advances in the combined use of machine learning and biosensing using electrolytic and SERS sensors, including the principles and fabrication of each. These sensors can be constructed from various nanomaterials, and their applications to biochips, successful use of data-driven analyses, and treatment of cancer, infectious diseases, heart disease, diabetes, and neurological disorders are discussed. The research also critically reviews many of the major obstacles currently facing the data-driven use of biosensing technologies, including dataset standardization, model explainability, clinical validation, reproducibility, and regulatory challenges. Future directions for research in biosensing technologies, including self-powered biosensors, explainable artificial intelligence, digital twinning, multimodal biosensing, and advanced healthcare systems, are also identified. This research work provides a roadmap for researchers interested in applying machine learning and biosensing technologies to develop highly accurate, scalable, and clinically relevant diagnostics for precision medicine and future innovations in healthcare.

KNA-11: Retinal Image Analysis with Vision Transformers: Recent Advances and Future Directions

Prof. Birendra Biswal

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Abstract

Deep learning has become a cornerstone of medical image analysis, enabling automated detection, classification, and segmentation of disease across modalities such as OCT, fundus photography, MRI, CT, and histopathology. While Convolutional Neural Networks (CNNs) have driven much of this progress through hierarchical, locally connected feature extraction, their fixed receptive fields and strong inductive biases limit their ability to model long-range dependencies and global anatomical context, both critical for interpreting complex retinal pathology. This talk examines how Vision Transformers (ViTs) address these limitations by replacing convolutional feature mixing with self-attention, allowing every image patch to interact with every other patch from the earliest layers. Building on this foundation, the talk traces the evolution from standard ViTs to hierarchical, computationally efficient variants such as the Swin Transformer, which uses shifted-window attention to make transformer-based analysis tractable for high-resolution medical images.

As a concrete case study, the talk presents **TMRF-Net**, a Transformer Encoder-based Multiscale Residual Fusion Network developed for segmenting retinal abnormalities such as intraretinal fluid (IRF), subretinal fluid (SRF), and pigment epithelial detachment (PED). TMRF-Net combines Dual Scale Dense Fusion (DSDF) for multiscale feature fusion, Transformer Embedded Encoder Blocks (TEEBs) for global context modelling, and Spatial Cross Attention (SCA) for precise encoder-decoder alignment. Evaluated on public datasets including RETOUCH, ORIGA, INSPIRE-AVR, and UCSD, TMRF-Net achieves state-of-the-art segmentation performance (Dice coefficient of 0.871, precision of 0.920), outperforming established baselines such as U-Net, Att-UNet, UNet++, and MsTGANet.

The talk concludes by discussing future directions for transformer-based architectures in ophthalmic and broader medical imaging applications, including improved interpretability via attention maps, multimodal integration with foundation models, and pathways toward robust, data-efficient clinical deployment.

KNA-12: Graph Neural Network and Its Application in Health Care

Prof. Bhawani Sankar Panda

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Abstract:

Traditional deep learning architectures such as Convolutional Neural Networks struggle to explicitly capture the topological dependencies, heterogeneous interactions, and multi-scale relational structures present in the data and hence suffers from performance loss. Graph Neural Networks (GNNs)—including Graph Convolutional Networks (GCNs) and Graph Attention Networks (GATs) have emerged as a dominant paradigm for non-eclidean relational data and are the modern deep learning architectures for such scenarios. As Biomedical data across clinical, genomic, and pharmacological domains are inherently non-Euclidean and structured as complex relational networks, GNNs are preferred deep learning architectures for health care applications. This talk will give an introduction of GNNs including GCN and GAT and will discuss their applications in Health Care Domain. Finally, some research challenges will be highlighted.

KNA-13: Sustainable Supply Chain Models: Towards Cleaner Systems in Healthcare, Agriculture, and the Aluminium Industry

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Abstract:

The increasing environmental impacts of production and transportation have accelerated global climate change, affecting ecosystems, human health, and economic sustainability. This talk examines manufacturers' environmental sustainability initiatives through a triple-bottom-line (economic, environmental, and social) perspective, emphasizing green investments in healthcare, agriculture, and the aluminum industry. The proposed sustainable supply chain models aim to achieve zero-waste production by integrating waste minimization, recycling, wastewater treatment, and carbon capture technologies to reduce greenhouse gas emissions. Advanced optimization models are developed to balance economic performance with environmental and social objectives while enhancing supply chain resilience. Numerical experiments and sensitivity analyses demonstrate the effectiveness and robustness of the proposed models under various operational scenarios. The results provide comparative insights into the impacts of green investment decisions, emission reduction strategies, and resource recovery on supply chain performance. Finally, managerial implications are presented to help decision-makers adopt emerging Industry 5.0 technologies, including artificial intelligence, digitalization, automation, and smart manufacturing. These technologies enable cost-efficient, resilient, and environmentally sustainable supply chains that promote zero waste, lower carbon emissions, efficient resource utilization, and long-term industrial sustainability.

KNA-14: LLMs for All: Building Inclusive Models for Low-Resource Languages

Dr. Shantipriya Parida

Senior AI Scientist at AMD Silo AI in Finland



Abstract:

In a world of approximately 7,000 languages, the benefits of Large Language Models (LLMs) remain concentrated on a small subset, leaving most low- and ultra-low-resource languages underserved. Even for many of these languages, LLM performance is constrained by data scarcity, limited tooling, and insufficient technological support. This talk addresses a central question: how can we design AI systems that truly serve all languages?

The talk addresses the challenges and end-to-end process of building Large Language Models (LLMs) for low- and ultra-low-resource languages. We explore this problem through two representative case studies: Odia (an Indic language) as a low-resource language and Sámi (an Uralic language) as an ultra-low-resource language. Drawing from these examples, we discuss practical approaches such as multilingual pretraining, transfer learning, tokenization strategies, and community-driven data development. The talk highlights key technical and practical challenges, design decisions, and lessons learned in building inclusive language technologies. We conclude with a vision for scalable and equitable AI that extends the benefits of LLMs to all language communities.

KNA-15: Designing Scalable AI-Driven Mobile Healthcare Applications Using Performance-Driven Modular Architecture

Madhuri Latha Gondi

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Senior iOS Mobile Engineering Consultant, USA



Abstract

Artificial Intelligence is rapidly transforming modern healthcare through intelligent diagnostics, real-time patient monitoring, and data-driven clinical decision support. As mobile health applications become increasingly central to healthcare delivery, ensuring scalability, reliability, and high performance has become critical. However, traditional monolithic mobile architectures often introduce tight coupling, limited scalability, and performance bottlenecks, which can negatively impact healthcare application responsiveness and reliability.

This invited talk presents a performance-driven modular architecture approach for designing scalable AI-driven mobile healthcare applications. The proposed architecture leverages modular design principles, Model-View-View Model (MVVM), and dependency injection to enhance maintainability, scalability, and system efficiency. The modular approach enables independent development of healthcare components such as patient monitoring modules, diagnostic support systems, medical data visualization, and mobile health communication services.

Empirical performance evaluation was conducted using real-world iOS applications and profiling tools such as Xcode Instruments. Key performance metrics including CPU utilization, memory consumption, application launch time, and responsiveness were measured under varying workloads. Results demonstrate significant improvements in scalability, reduced memory usage, improved application startup performance, and enhanced responsiveness compared to traditional monolithic architectures.

The talk will also discuss architectural best practices for AI-enabled mobile healthcare systems, scalable mobile health infrastructure, and performance optimization strategies for healthcare applications.

PART I

Artificial Intelligence for Medical Diagnostics

117-Autism Spectrum Disorder Classification Using a CNN-Based Deep Learning Framework

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Abstract

As a disease of steadily increasing incidence rates, Autism Spectrum Disorder (ASD) identifies neuronal developmental abnormalities characterized by social, communication, and behavioral difficulties. Till now, early interventions can significantly enhance the developmental outcomes for people with ASD. Early diagnosis is crucial. However, conventional diagnostic methods, such as the Autism Diagnostic Observation Schedule (ADOS) and the Autism Diagnostic Interview-Revised (ADI-R), rely heavily on subjective clinical assessment. To overcome these difficulties, this research paper proposes Machine Learning (ML) methods for ASD detection using a Convolutional Neural Network (CNN) trained on face-reorganized image data. To ensure consistency, the models in the initial studies used a hybrid architecture that integrated the Visual Geometry Group (VGG) model with sixteen convolutional layers and batch normalization (VGG16_BN), along with additional custom layers. These transfer learning techniques are used to improve model performance and accelerate convergence. The performance of several optimization approaches, i.e., RMSProp and SGD, will be examined in the second phase, Lightweight multimodalities, by combining facial photos with prosodic and speech characteristics. 1D-CNNs will handle audio signals represented as Mel-spectrograms. In order to create single representations for categorizations of late fusion method will be integrated visual and auditory embedded at the dense layer stages. This method's approach is appropriate for small-device implementations and captures complementary behavior. The standard metrics, including accuracy, precision, recall, F1 scores, and ROC-AUC, will be used to assess the model's performance. These fused modality visualizations will be used to evaluate interpretability. And the final stages interpretability outputs and Insights powered by GenAI to foster clinical trust.

Keywords: Autism Spectrum Disorder, Convolutional Neural Network, Multimodal Fusion, Lightweight CNN, Model Compression, Knowledge Distillation, Explainable AI, Speech Analysis, GenAI-Assisted Insights

130-A Lightweight Hybrid Mobile U-Net for Robust Localization of Optic Cup and Optic Disc from Fundus Images

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Abstract

Visual Impairment is the primary effect for visual loss and is affected by different irreversible retinal disorders such as Glaucoma. Regular analysis of Optic Cup (OC) and Optic Disc (OD) from the surface of retina will alert the expert ophthalmologists and minimize the damage at the early stage. However, the early detection of structural changes of OD and OC is a challenging task because of their variation in intensity distribution and size. Numerous existing automated deep learning algorithms like CNN based models extract local feature maps for contextual understanding. This limits the ability of long-range dependency of network due to the absence of global feature maps. Therefore, different large-scale Transformer based models integrate the global feature maps for understanding of overall anatomical arrangements on the retinal surface. Due to this, many Transformers based methodologies primarily utilize CNN inspired decoders for semantic segmentation. However, these models require more hyperparameters leading to computational complexity. To mitigate the computational complexity, an efficient lightweight hybrid Mobile U-Net (LHMU-Net) is implemented for combining the local and global feature maps at every stage of the network. This eventually highlights the pixel intensity distribution of OD/OC regions and increases the intraclass variance for better prediction of OC/OD pixels from input images. The effective significance of the implemented LHMU-Net is validated on three datasets and obtained an average accuracy of 99% and Dice score of 95.6% with the optimal hyper-parameter size of 1.02M and computational complexity of 4.06 GFLOPs, the proposed LHMU-Net has outperformed existing models in segmenting the OD and OC regions.

Keywords: Optic Cup, Glaucoma, Optic Disc, Long-range dependencies, Convolutional Neural Network, Transformer model.

128-Patch wise Ornstein-Uhlenbeck bridge diffusion for low dose CT denoising

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Abstract

Despite uncertainty about the nature of low-dose CT degradation, denoising them using deep learning methods gives good results. In this work, Patch wise Ornstein-Uhlenbeck Bridge (POUB) diffusion is used for LDCT denoising. The results are compared with existing state-of-the-art methods in Mayo 2016 dataset. The quantitative performance reveals that the proposed work outperforms the third-best compared method by +0.9741 dB PSNR, +0.47% SSIM. This method outperforms the best compared method in terms of SSIM and FSIM, proving that anatomical information is preserved even after accomplishing the complex denoising task. The high contrast between the lesion and the background in the resulted denoised CT proves that the method can be helpful for further abnormality diagnosis using radiologists or computer assisted means. The success of Patch wise Ornstein Uhlenbeck diffusion model for LDCT denoising shows that the bridge diffusion models have huge potential for medical image restoration.

Keywords: Low-dose CT · denoising · bridge diffusion.

137-Deep Learning-Based Detection of Uterine Fibroids in Ultrasound Images

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Abstract

Uterine fibroids, also called leiomyomas, are the most common form of benign tumors present in the uterus, affecting more than a quarter of the female population by the age of 50. The detection of uterine fibroids is complex and involved. These are usually detected when women undergo ultrasound scans and examined deeply by radiologists and gynaecologists. A typical patient workflow in a clinical diagnostics or hospital involving multiple patients, sequential scans, radiologist(s) analysis, gynaecologist(s) review and finalization adds to the complexity. This workflow induces potential human fatigue for radiologists in detecting fibroids accurately both in placements and dimensions. This paper explores and suggests the right Deep Learning Models, Architectures, Pipelines and Mechanisms on ultrasound images to automatically detect Uterine Fibroids. The goal of this auto-detection is to aid Radiologists and Gynaecologists as a Virtual Assistant. The authors explored various Deep Learning models and finally focused on two medical image segmentation architectures U-Net and nnU-Net. This paper describes a) the usage of publicly available ultrasound image dataset, b) the approach of training the models, c) the results of experiments using right metrics on these models with various parameters, and d) the suggested model to use for automatic fibroid detection. The paper finally converges on nnU-Net architecture, achieving 88.4% of inferenced images having a Dice score greater than 0.7 and 92% having a Hausdorff Distance less than 40 pixels.

Keywords: Uterine fibroids, ultrasound segmentation, U-Net, nnU-Net, deep learning, medical image analysis, 3D reconstruction, encoder backbone, transfer learning.

120-CHRONICA: A Comprehensive ICU Dataset for Chronic Disease Analysis

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Abstract

Chronic diseases are the world's key medical concerns. Disease diagnosis is getting more difficult as people have several chronic diseases at once rather than just one disease. Well-structured and multi-parameter healthcare datasets are essential for the accurate and early prevention of chronic diseases. Such datasets enable researchers and healthcare systems to analyse various chronic diseases simultaneously and improve the decision-making. This Data Note describes a dataset collected from Capital Hospital, Bhubaneswar, India, over a period of one year. The dataset includes 100 adult patients (age ≥ 18 years) admitted in critical condition. Clinical, haematological, and blood gas parameters were recorded at the time of admission. The dataset comprises demographic information, vital signs, laboratory parameters, and disease indicators. The dataset contains over 70 variables, including systolic and diastolic blood pressure, oxygen saturation (SpO₂), serum biomarkers (urea, creatinine, electrolytes), arterial blood gas (ABG) parameters, lipid profile, complete blood count (CBC), and liver function markers. Binary indicators for symptoms and chronic diseases are also included. This dataset provides a wide-range of multi-dimensional patients' data who have co-existing diseases. It supports exploratory data analysis (EDA), research on data augmentation, predictive modelling, and optimization in healthcare data science. This Data Note focuses on dataset description without analysis or modelling results.

Keywords: Chronic Disease Dataset, Clinical Data, Co-morbidity, Data Augmentation, Healthcare Data, Biomedical Dataset

115-Hybrid Deep Learning Architectures for Drug–Target Interaction Prediction: A Systematic Review

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Abstract

The prediction of Drug–Target Interaction (DTI) is a crucial stage of the drug discovery process. Traditional DTI prediction relies on wet-lab experiments. This process is expensive as well as time-consuming for screening the vast chemical drug compounds. Unlike traditional methods, Deep Learning (DL) models can capture high-dimensional relationships between drug molecules and protein targets. Hybrid models combine two or more DL models for accurate and scalable DTI detection. This systematic review analyses hybrid DL architectures anticipated for DTI prediction evaluated on the Davis benchmark dataset. A systematic literature search was carried out across Web of Science, PubMed, Scopus, Google Scholar, and IEEE Xplore published between 2022 to 2026. The review specifically examines hybrid frameworks that combine multiple DL models to predict DTI on the Davis dataset. The findings show that hybrid DL models consistently achieved better prediction accuracy than both machine learning (ML) and single DL models. The review further discusses the key benefits, existing limitations such as computational cost and data dependency for hybrid DL models in DTI prediction.

Keywords: Drug–Target Interaction, Hybrid Deep Learning, Davis Dataset, KIBA Dataset, Drug Discovery

104-CAFE-US: A Calibrated Federated Learning Framework for Trustworthy Breast Ultrasound Cancer Diagnosis

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Abstract

Amongst women, breast cancer continues to be one of the most common causes of cancer-related death and early and accurate diagnosis is paramount to the successful treatment of breast cancer. Conventional deep learning models are plagued by inconsistent image quality and speckle noise and privacy concerns, despite the widespread use of ultrasound imaging due to its safe and inexpensive nature. To satisfy these problems, we propose a federated learning framework, which is privacy-preserving and can be trusted, for breast ultrasound cancer diagnosis, called CAFE-US (Calibrated Adaptive Federated Ecosystem for Ultrasound Screening). This name is derived from the ability of the framework to integrate Calibration-aware Prediction, Adaptive Optimization, Federated Collaboration and a unified Computational Ecosystem for Reliable Clinical Decision Support. Notably, it combines a Swin Transformer backbone for feature extraction with FedProx to apply strong optimization under different data distributions; with the flexibility of Bayesian hyperparameter optimization-based efficient model tuning; and with the uncertainty estimation via Monte Carlo Dropout and conformal prediction to enhance prediction reliability. Experiments conducted on the BUSI, UDIAT, and BUS-BRA breast ultrasound datasets validate the proposed framework with an overall classification accuracy of 96.2%, enhances malignant lesion detection, well-calibrated confidence estimations and good test generalization in various clinical settings. The results show that CAFE-US is an promising method to enable a cancer detection of breast ultrasound while maintaining the privacy of the patient.

Keywords: Speckle Noise, FedProx-enabled federated learning, Monte Carlo Dropout, Conformal Prediction, Non-IID federated settings, Bayesian hyperparameter optimization

124-Reliable Diabetic Retinopathy Detection Using Convolutional Neural Networks with Evidence-Based Uncertainty Estimation

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Abstract

Diabetic retinopathy is widely recognized as a serious ocular complication that can lead to blindness in diabetic patients. The risk of blindness can be significantly reduced by early identification of diabetic retinopathy. Conventional screening techniques rely on ophthalmologists performing manual examinations, which can be time-consuming and produce variable findings. Automated computer-aided diagnosis systems are therefore necessary for accurate and effective detection. This paper proposes a convolutional neural network with an evidential learning framework, a deep neural network approach for multi-class classification of diabetic retinopathy. After processing retinal fundus images, the model classifies them into five diagnostic classes, which are no DR, mild DR, moderate DR, severe DR and proliferative DR. The suggested model, in contrast to conventional methods, includes an evidence-based output layer that estimates uncertainty by modeling predictions using a Dirichlet distribution. According to experimental results, the model provides accurate uncertainty estimation and performs well in classification. Higher uncertainty in inaccurate predictions is indicated by the mean uncertainty values of 0.181 for correctly categorized samples and 0.2374 for misclassified samples. Overall, the suggested approach provides an accurate and uncertainty-aware framework for identifying diabetic retinopathy from retinal images.

Keywords: Diabetic Retinopathy, Medical Image Analysis, Fundus Image, Deep Learning , Evidential Learning, Uncertainty Estimation.

98-Agent AI for Vertebrae X-ray Analysis: Explainable and Deployable Framework

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Abstract

The paper describes a deep learning-based framework for identifying keypoints on X-rays of spines using a fine-tuned DenseNet121 model. The model was trained using the VertebraeKeypoints50 dataset, which includes fifty vertebral keypoints. Images were first converted into grayscale, resized, and normalized for training, with 80% for training and 20% for validation split. The validation accuracy of the model was 99.02%, indicating consistent performance in detecting vertebral keypoints. The framework uses agent-based architecture for analysis, interpretation, and report generation of data. For increasing confidence and clarity for medical users, methods for Explainable AI (XAI), for instance, heatmaps, are used for indicating areas that affect predictions. A web interface allows users to upload X-rays, view points, and verify confidence scores along with explanations. The overall approach integrates accuracy, transparency, and usability, facilitating decision support and analysis for doctors and researchers of spinal X-rays.

Keywords: Vertebrae Keypoint Detection, DenseNet121, Medical Image Analysis, Explainable AI (XAI), Deep Learning Evaluation.

59- Intelligent Detection and Enumeration of Blood Cells for Malaria Screening using a Custom Convolutional Neural Network (CNN) Model

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Abstract

Malaria is a significant and dangerous transmissible disease spread to humans by Plasmodium parasites during the bites of female Anopheles mosquitoes. Early malaria diagnosis primarily depends on manual microscopic assessment of stained blood cells by trained laboratory technical experts. Though manual screening is broadly undertaken, it is highly time-consuming task, expert-dependent, and possibilities of manual errors. To successfully handle these limitations, the current work targets to build a regulated malaria discovery model that employs image processing and deep learning procedures to examine blood smear digital images. The approach directs on finding the key blood components, namely Red Blood Cells (RBCs), White Blood Cells (WBCs), and platelets, which undergo distinct variations during the period of malaria illness. The YOLOv8 object recognition algorithm is directed on a well-annotated image set in which each blood cell class is marked that enables accurate localization and categorization. When the blood cells are identified with bounding boxes, they are cropped as RBC, WBC and platelet image crops. These crops are fed to a custom designed CNN classification model to discriminate malaria infected and uninfected cell groups using RBCs. The proposed architecture produces the classification accuracy rates of 97.5%, 96% and 94.8% for RBCs, WBCs and platelets identification respectively. The customized CNN model achieves about 3% higher classification accuracy and a 2.4% higher F1-score than the conventional DenseNet model when identifying malaria infected and uninfected image crops.

Keywords: Blood Cells, Cell Count, Malaria, Microscopic Images.

09-An Experiment-Based Study on Identifying Depression Risk in Students Using Explainable Generative Artificial Intelligence

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Abstract

Early detection of depression is essential for improving student mental health. Traditional screening methods are often time consuming, subjective and difficult to scale in educational settings. This study presents an experiment oriented framework that combines Generative Artificial Intelligence (GAI) and Explainable Artificial Intelligence (XAI). The model uses psychological, academic and behavioral data to classify in low, moderate and high-risk groups. Experiments were conducted on a student mental health dataset containing 1,200 records collected between 2019 and 2022. The dataset includes 28 input features. Data preprocessing involved normalization, feature selection and train test splitting. A variational Autoencoder was used to learn latent representations. While Shapley additive explanations (SHAP) was applied to explain the model predictions. The proposed framework was compared with Logistic Regression, Random Forest and Deep Neural Network models. It achieved 92.8% accuracy, 91.6% precision, 91.2% recall and 91.4% F1 score. These results were higher than those of the baseline models. Feature attribution consistently identified depression score, anxiety level, sleep duration, academic workload and attendance irregularity as the most influential factors. The findings show that integrating GAI with XAI improves prediction performance while producing transparent and interpretable results. The proposed framework can support educators and counsellors in the early identification of students who may require mental health intervention.

Keywords: Student Depression, Generative AI, Explainable AI, Educational Data Mining, Mental Health Analytics

111- A Graph-Based Deep Learning Framework Integrated with Kuramoto Synchronization Dynamics for Pediatric EEG Seizure Pattern Analysis Using Cortical Network Connectivity and Spectral Feature Extraction

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Abstract

Detecting seizures in children's raw EEG readings with great reliability has proven to be a challenge that has not yet been met with an easy solution. The vast majority of deep learning frameworks currently available have treated each electrode on the scalp as an independent channel, thereby excluding any data regarding the spatial relationship between the two recording sites and the phase-coordination of the recruitment during seizures from any consideration in the calculations. To address these problems directly, we developed a structure based on Spectral Graph Convolutional Neural Networks (SGCNN), which constructs a graph using a pair-wise analysis of the Kuramoto synchronization index instead of the amplitudes from each of the electrodes. Each node in the resulting graph has a six-dimensional vector that consists of the five frequency bands for the EEG and the global scalar indicating the level of synchrony. Chebyshev polynomial filters facilitate the movement of information through this connectivity structure derived from observations on the conductance of neuronal populations. On the CHB-MIT pediatric epilepsy benchmark, our model achieved 89.33% accuracy and an AUC-ROC score of 0.908. We provide the results of control ablation experiments to demonstrate that both the Kuramoto-based graph structure and the spectral features of our nodes make statistically significant independent contributions to this overall performance level. The results of our leave-one-out cross patient tests yielded a mean accuracy of $84.7\% \pm 3.2\%$, which was expected to be less than the benchmark accuracy due to the variety of patients in that group. An analysis of the connectedness of the SGCNN graphs revealed that the average efficiency of the connectivity was 0.345 in the global configuration and 0.470 in the local configuration during active seizure periods.

Keywords: Graph Neural Networks, Kuramoto Synchronization, Pediatric Epilepsy, EEG Seizure Detection, Functional Connectivity, Ablation Study, Spectral Graph Convolution

24-Mental Health Detection Using Facial Expressions: A Deep Learning Approach

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Abstract

Mental health disorders are a major challenge worldwide. However, conventional diagnostic techniques are still subjective. The proposed paper investigates a methodology for automated depression detection. Utilizing advanced neural networks for facial recognition. We propose a two-layer deep learning model that combines spatial and temporal data. from recordings interview pa-tients. A ResNet-50 extracts the spatial stream. The temporal stream, a Bidirectional LSTM (BiLSTM), models the evolution of the facial landmarks, while the spatial stream learns to extract various features from raw video frames. Acts of Action The public assessment of the proposed model is evaluated. this task, the DAIC-WOZ dataset serves as a benchmark. The suggested. The dual stream model attains an F1 score of 0.821 and various AUC measures. The binary classification of depressed versus nondepressed group resulted in an AUC of 0.865. Single-stream baselines were outperformed by these results. The integration of state-of-the-art architectures is shown. Whether it is the spatial (appearance) or temporal (dynamic) facial feature, a combination of both is a robust strategy.

Keywords: Affective Computing · Mental Health · Facial Expression Recognition· Deep Learning · Depression Detection · BiLSTM · ResNet 50

136-Adaptive Confidence and Agreement Guided Hybrid CNN Framework for Plant Disease Classification

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Abstract

Automated plant disease identification is central to precision agriculture, given its role in timely intervention and stable crop yields. This paper introduces an Adaptive Confidence and Agreement-Guided Hybrid CNN Framework, coordinating three CNNs of varying complexity ShuffleNetV2, MobileNetV2, and ResNet18 within a difficulty-adaptive inference pipeline. Rather than applying all models uniformly, a routing mechanism assesses prediction confidence and inter-model agreement to determine processing depth: high-confidence agreements are classified directly, disagreements are resolved via confidence-weighted fusion, and only the most ambiguous samples are escalated to ResNet18. On PlantVillage, the framework achieves 99.70% accuracy, 99.45% F1-score, and 99% AUC; on the more challenging PlantDoc benchmark, it achieves 65.68% accuracy, 65.88% F1-score, and 96.31% AUC. These results demonstrate that adaptive, sample-driven model orchestration can balance accuracy and computational efficiency across both controlled and real-world conditions.

Keywords: Plant Disease Classification, Deep Learning, Hybrid CNN, ShuffleNet, MobileNetV2, ResNet18, Precision Agriculture

144-An Explainable Deep Learning Framework for Acute Lymphoblastic Leukemia Classification

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Abstract

Acute Lymphoblastic Leukemia (ALL) is a type of blood cancer caused by the abnormal growth of white blood cells. Traditionally, doctors manually examine peripheral blood smears under a microscope, which can be time-consuming and varies from doctor to doctor. Deep Learning models speed up this diagnostic process. However, they do not provide any explanation for their decisions, and their reliability is also questionable. This paper presents a framework for ALL classification that provides explainability and reliability. First, the white blood cells were segmented using a U-Net model with a ResNet34 encoder. The nucleus was segmented using HSI-L*a*b color space fusion and k-means clustering. From the segmented cell and nucleus, 36 handcrafted features were extracted. An EfficientNet-B3 model was used to extract deep features from the segmented cell. Both the handcrafted and deep features were fused together and passed into a Multi-Layer Perceptron (MLP) for classification. Grad-CAM was used to provide explainability, and Monte Carlo (MC) dropout was used to measure the uncertainty in the model prediction. The proposed method achieved an accuracy of 98.85%, precision of 99.29%, recall of 98.46%, specificity of 99.23%, and an AUC of 0.9981 on the ALL-IDB2 dataset. The proposed method provides high accuracy along with visual explanations and uncertainty measures.

Keywords: Acute Lymphoblastic Leukemia · Deep Learning · Feature Fusion · Explainability · Uncertainty

139-Liver Lesion Classification from Multi-Labeled Volumetric CT Scans Using HepatoSeqNet

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Abstract

Early detection and treatment are essential for liver cancer because early-stage disease often lacks prominent symptoms, which can lead to late diagnosis. This paper introduces HepatoSeqNet, a hybrid deep learning framework that combines a ResNet-18 backbone for extracting spatial features from individual slices with a Long Short-Term Memory (LSTM) network for modelling long-term dependencies between slices. This framework performs multi-label classification across five classes: Normal Liver Tissue, Liver Cyst, Cavernous Hemangioma, Hepatic Metastases, and Hepatocellular Carcinoma. The final configuration uniformly samples up to 60 axial slices from each volume, applies data augmentation, and trains using Binary Cross-Entropy loss with mixed-precision gradient accumulation. Five-fold evaluation yields an exact-match accuracy of $73.33\% \pm 5.16\%$, macro precision of $76.95\% \pm 6.17\%$, macro recall of $72.06\% \pm 2.70\%$, and macro F1-score of $73.98\% \pm 2.71\%$.

Keywords: Liver lesion classification · HepatoSeqNet · 3D Medical images · Deep learning · Long Short-Term Memory · ResNet

122- A Generalised Hybrid CNN-LSTM-ANN Model for Diabetes Prediction Across Multiple Clinical Datasets

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Abstract

Diabetes Mellitus (DM) is amongst the most widespread chronic metabolic disorders across the globe. Early and accurate prediction of DM poses a significant challenge due to the heterogeneous nature of healthcare datasets, class imbalance, missing values, and complex nonlinear relationships among clinical and lifestyle-related features. Existing Machine Learning (ML), specifically Deep Learning (DL) models, often demonstrate high performance on individual datasets but suffer from limited generalisation capability across diverse healthcare environments. To address this issue, the present study proposes a robust Hybrid Convolutional Neural Network-Long Short-Term Memory-Artificial Neural Network (CNN-LSTM-ANN) framework.

Integration of convolutional feature extraction, sequential dependency learning and dense neural representation into a unified predictive framework has been done in the proposed architecture. The model has been evaluated and tested using three publicly available standard datasets: the PIMA Indian Diabetes Dataset, the Behavioural Risk Factor Surveillance System (BRFSS) and the Early Stage Diabetes Risk Prediction Dataset (ESDRP). To improve robustness and predictive stability, extensive preprocessing techniques were applied, including median imputation, Z-score-based outlier removal, quantile transformation, label encoding, and SMOTE-based class balancing.

Experimental results demonstrated stable and effective performance across heterogeneous datasets, achieving prediction accuracies of 96.00%, 95.54%, and 94.71% on the PIMA, Early-Stage Diabetes, and BRFSS datasets, respectively. Statistical evaluation using Analysis of Variance (ANOVA) and paired *t*-tests showed that the proposed hybrid model significantly outperformed traditional ML approaches such as Support Vector Machine (SVM) and Random Forest (RF), while maintaining competitive performance with advanced DL models, including DNN and RNN/LSTM architectures. The major innovation of this study lies in the development of a generalised hybrid DL framework capable of maintaining balanced predictive performance across both clinical and large-scale survey-based healthcare datasets.

Keywords: Diabetes Mellitus · Deep Learning · Hybrid CNN–LSTM–ANN · Diabetes Prediction · Healthcare Analytics · Machine Learning · Explainable Artificial Intelligence · BRFSS. PIMA Dataset · ESDRP Dataset

149-An Intelligent Computing Approach for ECG-Based Myocardial Ischemia Detection

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Abstract

Myocardial ischemia is a serious cardiovascular disease due to decreased blood flow to the heart muscle and thus oxygen deprivation which can cause such severe conditions as myocardial infarction and heart failure. This paper provides an approach based on intelligent computing for characterization of ECG signal and identification of myocardial ischemia. Firstly, ECG signal is preprocessed applying the Butterworth bandpass filter in order to remove noise and baseline drifts while keeping clinically relevant signal components. Then, features of signal are extracted using time domain analysis, frequency domain analysis and time-frequency domain analysis. Heart rate estimation and heart rate variability analysis are conducted using R-peak detection method. Various diagnostic features like ST-segment deviation, T-wave abnormalities, Low-Frequency (LF) power, High-Frequency (HF) power, signal energy, RMS value, mean and standard deviation are used as input features for intelligent computing approaches to characterize ischemic ECG changes. Obtained results indicate that the suggested approach successfully identifies changes in ECG morphology and frequency characteristics in case of myocardial ischemia.

Keywords: Intelligent Computing, Intelligent Communication Systems, ECG Signal Analysis, Myocardial Ischemia Detection, FFT, PSD, Spectrogram, Discrete Wigner–Ville Distribution, Heart Rate Variability, Clinical Decision Support Systems, Telecardiology.

123-MedAgent: Enterprise Multi-Agent Expert System for Healthcare Management

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Abstract

This study explores the transformative potential of Agentic AI in healthcare management, defining its capacity for autonomous reasoning, task execution, and proactive decision-making. Healthcare facilities often operate on 24/7 schedules, requiring higher levels of autonomy to accelerate operational efficiency, as traditional data analytics and process automation are insufficient. Agentic AI addresses these challenges by shifting clinical, pharmacy, and administrative workflows from reactive processes to intelligent and self-orchestrating systems. This study proposes "MedAgent," a multi-agentic system designed to optimize re-source allocation, automate complex administrative tasks, and facilitate dynamic care coordination, thereby significantly reducing the cognitive load on human providers. Experimental results demonstrate that MedAgent achieves up to 91% accuracy, outperforming single-agent Large Language Model (LLM) baselines.

Keywords: Multi-agent AI · Healthcare AI · Agentic systems · Retrieval-Augmented Generation · LLM-as-a-Judge · Clinical decision support · AutoGen · LangGraph · FHIR R4 · Large Language Models (LLM)

PART II

AI in Future Healthcare

109- Early Alzheimer's Risk Detection Using a Collaborative Multi-Agent Cognitive Framework

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Abstract

Alzheimer's disease (AD) is a progressive neurodegenerative disorder that is often diagnosed after significant cognitive deterioration has occurred, limiting the effectiveness of therapeutic interventions. Early identification of subtle and evolving cognitive impairments remains a major challenge due to the heterogeneous nature of clinical symptoms. This paper presents a collaborative multi-agent cognitive framework for early Alzheimer's risk detection using longitudinal clinical data and explainable decision support. The proposed architecture consists of eight interconnected layers, including human cognitive signal acquisition, multi-domain cognitive encoding, cross-cognitive interaction fusion, brain-inspired decision orchestration, collaborative cognitive agents, inter-agent reasoning, longitudinal progression modeling, and explainable clinical support generation. The framework integrates behavioral, emotional, speech-related, cognitive, and lifestyle indicators to capture comprehensive disease-related patterns. Transformer-based fusion mechanisms and BiGRU-based temporal modeling are employed to analyze cross-domain interactions and cognitive progression trajectories. Furthermore, specialized cognitive agents collaboratively evaluate multiple aspects of disease evolution and generate consensus-driven risk assessments. Experiments conducted on the ADNI Augmented dataset, with comparative analysis using the OASIS Alzheimer's dataset, demonstrate promising performance, achieving a validation accuracy of 97.0% and a macro F1-score of approximately 97.0%. The proposed framework provides interpretable risk predictions, progression-aware insights, and caregiver-friendly recommendations, thereby supporting timely clinical decision-making and early intervention strategies for Alzheimer's disease management.

Keywords

Alzheimer's Disease, Early Diagnosis, Multi-Agent Systems, Longitudinal Modeling, Cognitive Computing, Clinical Decision Support.

86-AI-Enhanced Cloud IoT Framework for COPD Patient Air Quality Management

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Abstract

Air pollution is a primary risk factor for human health. Chronic Obstructive Pulmonary Disease (COPD) patients are especially vulnerable to air pollution. Effective healthcare systems for COPD monitoring need two features for reliable long-term use. These two features are real time air quality assessment and strong sensor validation. This study presents a cloud-enabled air quality monitoring IoT prototype. This prototype includes an AI driven self-diagnostic module also. This module provides a unified view of system health through a real time monitoring interface by continuously assessing sensor reliability. Thus, it ensures that data remains trustworthy. The system is built around an ESP32 microcontroller and four types of low-cost sensors. Each sensor is chosen for its relevance to respiratory health. The microcontroller is integrated with cloud through Wi-Fi and that enables real-time monitoring and threshold -based alerts. Real-time data storage in a Google-Sheet enables for an additional level of data backup and the health-check analysis of sensor data by the AI module.

Keywords: Internet of Things (IoT), Air Quality Monitoring, Sensor Reliability, COPD Management, Smart Healthcare Systems

125-AI-Driven Yoga Mudra Recognition with False-Mudra Rejection for Accessible Wellness of Visually Impaired People: A Comparative ML/DL Study

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Abstract

Yoga mudras are therapeutic hand gestures rooted in Ayurvedic science with benefits for cardiac health, immunity, and mental wellness. They remain inaccessible to visually impaired people (VIP) due to the complete absence of any AI-driven assistive tool. We present a novel 14-class yoga mudra dataset comprising 13 yoga mudras and a dedicated False/Null class. The inclusion of False/Null class explicitly rejects invalid finger configurations rather than forcing every input into a known mudra class, a critical safety requirement for eyes-free VIP use. The dataset was constructed using MediaPipe Hands landmark extraction from two participants using the right hand and expanded to 30,828 samples through left-hand lateral mirroring and landmark-level augmentation. We benchmark ten classifiers including SVM, Random Forest, XGBoost, LightGBM, CatBoost, KNN, Logistic Regression, and MLP, reporting accuracy, F1-score, confusion matrices, ROC/AUC curves, per-frame inference latency, and model storage size. MLP (3-Layer DNN) achieves the best result of 99.72 % accuracy with a per-frame latency of 0.004 ms and a model size of 602.65 KB, surpassing the best-reported accuracy in prior yoga mudra recognition works while additionally incorporating the rejection class as a safety requirement for eyes-free VIP use. A live webcam test validates real-time performance, establishing MLP as the optimal candidate for future on-device VIP deployment.

Keywords: Yoga mudra recognition · visually impaired · false mudra rejection · assistive technology · MediaPipe Hands · MLP · 14-class yoga mudra dataset · on-device inference

106-Federated Learning for Breast Cancer Prediction: Comparative Analysis of Traditional and Ensemble Models

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Abstract

Breast cancer prediction is one of the major research areas in the medical field as early identification leads to increase in patients' survival rates. Traditional machine learning methods have been used widely for breast cancer prediction. However, as data privacy and the need to share information between hospitals have become more important, new decentralized methods like Federated Learning (FL) are becoming popular. In this paper we provided a framework to compare the performance of different traditional methods and ensemble methods in centralized and federated learning Environment. Here the UCI repository dataset has been used for the centralized experiments and a synthetically expanded dataset has been used for federated framework for larger data requirements' data is preprocessed by checking its duplicity and null values. The experiment describe the learning procedures to perform something better than the machine learning model in a traditional way and also, they perform stronger in the federated environment and showing their robustness in decentralized environments. This shows that using ensemble models with federated learning can provide accurate results while keeping patient data private.

Keywords: Federated Learning, Ensemble Learning, Decentralized Learning, Machine Learning Algorithms, Synthetic Dataset

143-Deep Attention-D3 Q-Network with Bald Eagle Search–Agentic AI Swarm Hybrid Optimization for Schizophrenia Detection Using EEG Signals

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Abstract

Schizophrenia is a complicated, chronic mental health disorder characterized by early signs mimicking mental stress, depression, anxiety, difficulty in remembering things, and more often forgetting to maintain their own hygiene. Schizophrenia is a debilitating mental illness with symptoms like positive, negative, and cognitive, and has evolved as a major public health issue amongst today's young adults due to a combination of genetic vulnerability and disruptive agents. Due to the complex nature of the disease, conventional Schizophrenia diagnosis techniques, including the Rorschach Inkblot Test, Cognitive testing, and Positive and Negative Syndrome Scale (PANSS) test, etc., to name a few, are time-consuming and prone to error. Recently, with the advent of advanced machine learning techniques such as Deep learning technologies along with swarm intelligence-based metaheuristics optimization techniques, clinicians could use EEG signals and possibly identify schizophrenia at an early stage, may be during the prodromal or “at-risk” stage to have a better personalized healthcare. This study proposes a hybrid Deep Attention-based Dueling Double Deep Q-Network (DA-D3QN) optimized using the Bald Eagle Search (BES) algorithm combined with an Agentic AI swarm framework for automated schizophrenia detection using EEG signals. Experiments were conducted on the OpenNeuro Schizophrenia Dataset with 19-channel EEG signals sampled at 256 Hz. The proposed hybrid framework demonstrates superior convergence stability, improved classification accuracy (95.3%) with strong interpretability, and statistical validation over CNN, LSTM, and conventional Double DQN baselines (paired t-test with $p < 0.005$).

Keywords: Schizophrenia, EEG, Deep Reinforcement Learning, D3QN, Bald Eagle Search, Agentic AI Swarm framework, paired t-test

150-A Conditional Adversarial Defense Approach for Image Data

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Abstract

Adversarial attacks expose critical vulnerabilities in decision-making models, such as deep neural networks. Generally, these attacks generate carefully created perturbations and inject them into the input images in order to manipulate the model's predictions and, at the same time, make visually imperceptible changes to humans. In this article, we propose a hybrid and condition-based adversarial defense framework that integrates adversarial detection and selective denoising to improve robustness against perturbation-based attacks. The proposed framework first analyzes an input using an adversarial detector and routes only the suspicious sample to a denoiser before classification, while clean inputs are directly fed to the classifier. We have used three different adversarial detection methods, namely kernel density estimation with Bayesian uncertainty (KD-BU), local intrinsic dimensionality (LID), and feature squeezing (FS). The suspicious samples are denoised using a denoising autoencoder. The detectors and denoiser are used independently and together for evaluating the proposed framework's performance. An experimental study on the MNIST and SVHN datasets using fast gradient sign (FGS)-based attacks demonstrated that the proposed framework significantly improved adversarial robustness with improved overall performance. The results further highlighted the effectiveness of conditional purification and provided insights into the behaviour of different detection methods under varying attack strengths.

Keywords: Adversarial generation, Adversarial defense, Adversarial machine learning, Image filtering, Deep learning.

151-Agent Security in Healthcare AI Systems

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Abstract

The integration of agentic AI systems into clinical infrastructure marks a fundamental shift toward systems capable of autonomous reasoning, planning, and multistep task execution. While these systems offer significant benefits for clinical decision support, patient monitoring, and workflow automation, they also introduce security, privacy, and governance challenges that extend beyond traditional cybersecurity approaches. This study reviews agentic healthcare AI fundamentals and focuses on the changing threat environment, which includes threats associated with memory manipulation, prompt injection, identity breach, unauthorized tool usage, and multiagent interactions. We examine emerging security strategies, including differential privacy, federated learning, secure orchestration, behavioral monitoring, zero-trust architectures, and cryptographic identity systems. To demonstrate the integration of technological controls and governance processes, a layered agentic security architecture for healthcare AI is shown. To facilitate the safe implementation of autonomous healthcare systems, important research concerns pertaining to memory integrity, transparency, assessment, and long-term resilience are highlighted.

Keywords: Agentic AI, Healthcare Cybersecurity, Zero Trust Architecture, AI Governance, Patient Safety, Privacy-Preserving AI, Multi-Agent Systems.

PART III

Intelligent Computing and Communications

129- Building a Pre-train LLM Dataset for the Low Resource Odia Language

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Abstract

In the field of Large Language Models (LLMs), significant advancements have predominantly focused on a limited set of languages, raising concerns in linguistically diverse regions such as India, where a wide array of regional languages are spoken, and the majority of individuals communicate in native languages other than English. Building any foundation LLM requires a huge amount of quality data, and the case is more critical for the low-resource Indic languages where the availability of data on the web is still limited due to a lack of digitization.

In this paper, we introduce a large pre-training dataset in the Odia language, useful for building a pre-trained LLM. We built a data collection and validation pipeline, utilizing OCR and automated web scraping. We have compiled a collection of data that spans across various domains and includes major Odia dialects. The dataset contains more than 300 million Odia tokens. The proposed idea can be easily configured for other Indic and, most importantly, low-resource languages. The resulting dataset will be made freely available for all LLM pre-training and research purposes.

Keywords: Odia language, pre-training dataset, large language model, low-resource NLP, Indic languages

48-Deep Learning-Based Face DeepFake Image Detection System

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Abstract

The paper proposes an efficient light-weight convolutional neural network (CNN) for manipulation and deepfake detection in online media. With the proliferation of sophisticated image manipulation tools and the emergence of generative models, it is becoming increasingly important to identify forgery in the digital world for digital forensics and information security purposes. Advanced image editing tools and generative models have made it easy to produce visual content that has been manipulated, and accurate identification is critical for digital forensics and information security. The proposed CNN is able to effectively detect spatial inconsistencies and subtle artifacts created in the image manipulation process with low computational complexity. The model is tested on benchmark datasets with real and fake images, and it shows excellent performance in terms of accuracy, precision, recall, and F1 score. Experimental results indicate that it is able to distinguish correctly between real and fake images with low computational complexity. The proposed method ensures a trade-off between detection accuracy and efficiency, making it appropriate for real-time and large-scale forensic tasks, and demonstrating the potential of lightweight CNN architectures for enhancing automated deepfake and image forgery detection.

Keywords: DeepFake Detection, Deep Learning, CNN, Image Classification, Computer Vision.

73-BreathEasy: A Real-Time Asthma Risk Predictor Using Environmental Data

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Abstract

A persistent disconnect exists between what environmental science knows about asthma triggers and what individual patients can act upon in real time. Air-quality data exist in abundance and are increasingly accessible to the public, yet they remain too technical for most patients and clinicians to interpret at the point of care. This paper argues that closing this gap requires not more data, but smarter translation platforms, capable of converting raw meteorological and particulate measurements into immediate, personalized health signals. To this end, we present BreathEasy, a real-time, multi-page web-based decision-support tool that bridges population-level environmental monitoring and patient-specific asthma risk communication across ten major Indian cities. The platform integrates live environmental data through a transparent, multi-variate weightedscoring model that synthesizes pollutant concentrations, meteorological variables, and individual health profiles into a unified risk score. A stateful patient module records daily symptom logs and dynamically adjusts risk thresholds based on each patient's preceding 14 day clinical trajectory, while a rule-based clinical suggestions engine maps risk tiers, age groups, and severity classifications to 48 unique personalized guidance outputs. The platform operates reliably in both live and graceful fallback demonstration modes without user-facing interruption. These results demonstrate the feasibility of a transparent, interpretable, and personalized asthma decision-support platform aligned with India's Smart Cities Mission. Unlike opaque machine-learning approaches, the rulebased architecture of BreathEasy enablesis designed to support clinician trust, patient comprehension, and regulatory auditability, offering a replicable model for integrating environmental informatics into smart-city digital health infrastructure.

Keywords: Asthma Management, Environmental Health Informatics, Air Quality Index, Real-Time Decision Support, Urban Public Health, India Smart Cities, Transparent AI

118-AI-Based Agricultural Decision Support System for Crop Recommendation

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Abstract

The use of data to make decisions in farming is really important for growing crops and taking care of the earth. This paper is about a system that helps farmers make choices about what crops to plant and how to use fertilizer. The system has three parts: one that suggests what crops to plant one that suggests how to use fertilizer and one that looks at past farming data. The crop selection part of the system looks at the soil and the environment to figure out what crops will do well. The fertilizer part of the system looks at what the crops and soil need to stay healthy. The system also has a part that looks at farming data and shows it in a way that is easy to understand so farmers can see what has worked well in the past and make plans for the future. All of the data is stored in one place. It is easy to use and all the parts of the system can work together. The system was. It seems to help farmers make better decisions and take care of the earth. Data and good analysis methods are used to make sure the system is working well and that farming is sustainable. The system is good for farming because it uses data to make decisions and it helps farmers take care of the earth. The data-driven system is helpful for farmers. It is good, for the earth.

Keywords— Crop Recommendation; Fertilizer Recommendation; Decision Support System; Data-Driven Agriculture; Soil Analysis; Sustainable Farming; Predictive Analytics.

92- Robust Low-Complexity Learning-Assisted Equalization for Massive MIMO Systems under Imperfect CSI

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Abstract.

In this research work, an advanced and low-complexity learning-aided equalization solution for massive multiple input multiple output (mMIMO) systems in the presence of imperfect channel state information (CSI) is presented. Classic linear equalizers such as ZF and MMSE suffer from noise amplification or expensive matrix inversions that become impractical when dealing with massive antenna systems. Besides, both algorithms experience poor performance due to estimation errors in the channel response. As a result, in this work, a hybrid equalization method consisting of two stages is suggested. In the first step, the approximate MMSE equalizer based on the Neumann series is used to decrease computational costs without performing complex calculations. In the second step, the neural refinement module is utilized to mitigate the impact of residual interference and CSI estimation errors. It should be mentioned that the proposed framework provides an effective balance between performance and complexity and is appropriate for future deployment in 5G/6G massive MIMO systems. Simulation results obtained using the Rayleigh fading channel proves that the suggested approach performs better than classical approaches in terms of BER and MSE metrics.

Keywords: Massive MIMO, Imperfect Channel State Information, Low-Complexity Equalization, Hybrid Equalization Framework

78-Hybridisation of BiLSTM and EfficientNetB0 for Deepfake Video Detection

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Abstract

Deepfakes are becoming an increasingly popular weapon for undermining digital trust and it is getting harder to tell real videos from fake ones. Traditional approaches have difficulty with this because they tend to analyze videos frame-by-frame, missing the imperfections that manifest through time. In this paper, we tackle this problem adopting a hybrid deep learning strategy that models both the spatial information in video frames and the temporal dynamics by sequences of frames. Our model is based on EfficientNet-B0 for the extraction of spatial features, two layers of bi-directional long short-term memory (BiLSTM) for temporal sequence learning, and a Soft Attention Mechanism. The testing accuracy of the system reached 82.48% and the recall rate for "Fake" class was astonishing 97%, which indicates our method is robust in detecting manipulated contents with low false positive rate.

Keywords: Deepfake Detection, EfficientNet-B0, Bi-Directional LSTM, Attention Mechanism, Digital Forensics, Video Analysis

22-Design of a Nonlinear Channel Equalizer Using a Zebra-Inspired Multilayer Perceptron Prediction Mechanism

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Abstract

Nonlinear channel distortions and ISI substantially degrade the performance of linear equalisers at modern wireless systems. To address these limitations, this work presents a novel nonlinear equalization scheme using Zebra Optimization Algorithm (ZOA)–driven Multilayer Perceptron (MLP) equalizer. In this method, the MLP is used to represent inverse behaviour of the nonlinear channel and ZOA effectively determines an optimal vector for the weights and biases in training process so that the mean square error (MSE) among transmitted symbols and equalized output is reduced. The population-based lookup feature of ZOA makes the search in solution space flexible and efficient by overcoming the weaknesses of gradient-based optimization methods, such as slow convergence speed and getting stuck in local minima. The proposed approach is assessed on nonlinear channels with additive white Gaussian noise. Simulation results show that the proposed approach can outperform conventional linear equalizers, as well as NNs trained in a traditional way indicating its potential effectiveness of using it to nonlinear channel equalization in wireless communications.

Keywords: Channel Equalization; Multilayer Perceptron; ZOA-MLP; MSE

112- Machine Learning–Driven Spatial Modelling of Groundwater Nitrate Distribution under Hydrogeological Controls,

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Abstract

This study presents a geology-informed GIS–machine learning framework for modelling groundwater nitrate distribution in Cuttack District, Odisha. Recognizing that nitrate occurrence is controlled by both anthropogenic inputs and aquifer characteristics, geological, lithological, geomorphological, and land-use variables were integrated to capture spatial–environmental interactions. A total of 324 groundwater samples (0.12–119.3 mg/L) were analysed, and an Inverse Distance Weighting (IDW) interpolation surface was generated as a baseline representation. Machine learning models, including Random Forest and Gradient Boosting, were trained using GIS-derived predictors to account for subsurface heterogeneity and nonlinear nitrate transport processes. Gradient Boosting achieved the best performance (RMSE = 15.84 mg/L; $R^2 = 0.98$), outperforming both IDW and Random Forest. The validation difference map showed minimal spatial bias, with localized deviations in highly permeable alluvial zones. The results highlight the critical role of geological controls in nitrate mobility and demonstrate that GIS–ML integration provides a robust framework for groundwater quality assessment and hotspot identification. Unlike conventional nitrate interpolation studies, the present work explicitly integrates hydrogeological controls (lithology, geomorphology, geology, and land use) into ensemble machine learning frameworks to improve interpretability of nitrate mobility in heterogeneous alluvial aquifers of eastern India.

Keywords: Machine Learning, Groundwater nitrate, QGIS, Hydrogeology

77- AI-Based Energy Consumption Optimization in Industrial Automation Systems

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Abstract

The growing need to conserve energy in industrial settings has driven the acceleration of artificial intelligence (AI) incorporation within automation. The current paper presents a systematic survey of AI-based techniques for energy optimization in industrial automation systems, complemented by two original contributions: a proposed four-layer IIoT-edge-cloud system architecture for closed-loop energy governance, and a Bayesian Transformer deep learning model for multivariate industrial energy demand forecasting. The traditional methods, such as rule-based logic and a fixed timetable, cannot be used to tackle the dynamic, nonlinear and high-dimensional character of the present industrial energy patterns. Solutions based on AI, including machine learning (ML), deep learning (DL), reinforcement learning (RL) and federated learning (FL), present responsive, data-driven avenues to major energy savings without sacrificing the operational throughput or quality of products. This paper is an orderly evaluation of the state of art in AI-based energy optimization, which includes predictive modeling, anomaly detection, real-time control, and intelligent scheduling. An architecture is proposed that includes edge computing, digital twin technology, and multi-agent systems integrated with AI inference engines and more to keep the energy governance a closed loop. Exceptional outcomes of the experiments based on the case studies published and simulation benchmarks show that the energy saving is between 12 and 38 percent in such spheres as automotive manufacturing, chemical processing, building automation, industrial microgrids, CNC machining, and robot trajectory planning. The article also investigates major issues like data scarcity, the interpretability of models, cybersecurity, and computation overheads and provides a pathway into future research, such as physics-informed neural networks, foundation models of energy, and quantum-aided optimization. The results substantiate the fact that AI is a groundbreaking paradigm of managing industrial energy, which supports the goals of economic competitiveness and decarbonization of the world.

Keywords: Artificial intelligence; Energy optimization; Industrial automation; Deep learning; Reinforcement learning; Digital twin; IIoT; Smart manufacturing and energy efficiency

141- Enhancing Plant Disease Classification: A Lightweight Deep Learning Approach with DCGAN Augmentation and Grad-CAM Explanations

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Abstract

Plant diseases affect agricultural productivity, crop quality, and food security worldwide. Deep learning has witnessed many breakthroughs in automated plant disease detection, but many of the current models suffer from dataset imbalance, with minority disease classes having too few training samples, resulting in biased learning and poor generalisation. This research proposes an explainable lightweight deep learning framework combined with Deep Convolutional Generative Adversarial Networks (DCGANs) for synthetic image augmentation and dataset balancing to deal with this issue. Five CNN architectures, namely ResNet18, ResNet50, DenseNet121, EfficientNet-B0, and MobileNetV2, were evaluated using a PlantVillage-derived dataset. Performance was evaluated in terms of accuracy, precision, recall, F1-score, ROC curves, confusion matrices, and computational efficiency.

Experimental results showed that the augmentation strategy based on DCGAN led to better minority class representation and classification performance. The highest performance in terms of accuracy and inference efficiency with 97% accuracy was exhibited by MobileNetV2. In addition, Explainable AI using Grad-CAM increased the transparency of prediction and practical application of decisions in agricultural.

Keywords. Plant Disease Detection, Explainable AI, MobileNetV2, Grad-CAM, DCGAN, Severity Estimation, Deep Learning, Smart Agriculture.

140- AI-Based Personalized Fatigue Risk and Attention Monitoring System Using Eye and Posture Analysis

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Abstract

This paper introduces an AI-Based Personalized Fatigue Risk and Attention Monitoring System by incorporating eye and posture analysis. Computer vision techniques are applied for monitoring the real-time eye movement, blinks, posture alignment and attentiveness using standard webcam. No dedicated hardware or wearables were used, and the user behaviors were analyzed by detecting facial landmark and body posture using deep learning methods. The adaptive and flexible personalized baseline learning system was adopted, which helps the system to learn the user's normal behavioral patterns. The system continuously calculates the Fatigue Risk Score (FRS) and Digital Wellness Index (DWI) and analyzes user's condition by comparing the current observed behaviors with the baseline behaviors. In the system, future possible fatigued states and necessary wellness instructions are predicted by this system. These are displayed through an interactive dashboard. Experiments showed the effectiveness of the proposed system in detecting fatigue symptoms and attention loss and a relatively low implementation cost was achieved, which can be applicable in educational institutes, working places, software developing companies, and tele-working environment for health monitoring purposes.

Keywords: Fatigue Detection, Attention Monitoring, Computer Vision, artificial intelligence, digital wellness, eye tracking, posture analysis

114- A Hybrid Deep Learning Framework for Automatic Modulation Recognition Using CNN-BiLSTM with Attention Mechanism

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Abstract

Automatic Modulation Recognition (AMR) is highly significant in wireless communication systems, where automatic recognition of different modulations can be performed. Modulation recognition helps in spectrum monitoring, cognitive radio, surveillance, and intelligent wireless communication. This recognition becomes more difficult because of signal distortions in communication and the variation of conditions within a dynamic communication channel. This research work presents a deep learning-based AMR approach that uses a convolutional neural network (CNN), a bidirectional long short-term memory (BiLSTM), along with an attention mechanism. CNN helps in the extraction of local signal features while BiLSTM performs learning the time dependencies within communication signals. Meanwhile, the attention mechanism gives emphasis on important signal information. Experiments were conducted using RadioML2016.10a data set comprising signals of different modulation categories under varying conditions. Based on the experimental findings from the dataset, the suggested method yielded a loss value of 0.2316 and a classification accuracy of 93.15%, and the performance of the model was also analyzed through a confusion matrix and a classification report. The experimental results reveal that a combination of CNN, BiLSTM, and the attention mechanism provides enhanced feature learning capabilities for the AMR problem.

Keywords: Modulation · Deep learning · Attention mechanism · Performance evaluation · Wireless Communication.

116- Configurable Key-Length mCrypton to be used in Re-source-Constrained Embedded Systems for IoT Application

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Abstract

In this research, a hybrid key length architecture implementation for mCrypton light weight block cipher is discussed. The Hardware architecture is optimized for supporting the all the key length variants of 128-bit, 96-bit and 64-bit which are supported by mCrypton algorithm. The main idea for different key length was that by changing the key length one can change the level of security. The hardware architecture for the mCrypton lightweight block cipher that execute encryption for 64/96/128 bit is proposed. If one needed to simulate or use the different key lengths of 128 bits, 96 bits and 64 bits one might need three different architectures but with the help of hybrid key length architecture one can get all the three different key lengths variants in one architecture. The architecture's data path is of 64 bits wide. The implementation is being done on the Field Programmable Gate Array (FPGA) Virtex-6 xc6vlx75t-3ff784.

Keywords: FPGA, Hardware architecture, mCrypton, key length, lightweight block cipher.

58- TinyML-Based Human Activity Recognition: Memory–Accuracy Tradeoff Analysis

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Abstract

This Study uses Human Activity Recognition(HAR), which uses inertial sensor data from devices has various applications in the day-to-day world. While classification of various machine learning models have been on the basis of their performance and activities of the end users, their deployment on microcontroller-class hardware requires optimizations across four categories: accuracy, weighted F1 score, serialized model size, and single-sample inference latency. This study analyses the trade-off between memory usage and performance in TinyML-based models: Random Forest, Dense Neural Network(DNN), and one-dimensional Convolutional Neural Network(1D CNN). Each architecture is further evaluated in three TensorFlow Lite quantization variants: Float32 baseline, Dynamic Range INT8, and FullINT8, resulting in seven model configurations. This study thus provides us with concrete, simulation-grounded deployment guidelines for TinyML. The paper advances by providing a very systematic, structured, and multimetric evaluation of various model compression strategies and hence establishing an analysis for memory-constrained deployment on microcontrollers.

Keywords: TinyML · Human Activity Recognition · Quantization · Edge Computing · Neural Networks · Memory-Accuracy Tradeoff · Dense Neural Network(DNN) · Convolutional Neural Network(1D CNN) · Random Forest

148- Influence Maximization in Complex Networks

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Abstract

Because of its commercial potential, influence maximization is a significant research subject in the field of network science. It necessitates choosing seed nodes, also known as spreader nodes or important nodes that disseminate the information throughout the entire network. Weighted networks are seen in many real-world networks, including social, communication, and transportation networks. Compared to an unweighted network, it becomes more intriguing in a weighted network. On a number of real-world and artificial datasets of various sizes and characteristics, we evaluate the effectiveness of the suggested enhanced Weighted Improved NCVoteRank approach against the widely used centrality metrics, weighted degree, weighted closeness, weighted betweenness, weighted h-index, weighted VoteRank, improved weighted VoteRank and NCVoteRank. We compute the infection scale, the final infected scale as a function of time, and the average distance between spreaders using the popular stochastic susceptible–infected–recovered (SIR) information diffusion model. According to the simulation findings, the suggested approach — Weighted Improved NCVoteRank — performs far better than the other approaches mentioned above, including the most recent improved WVoteRank.

Keywords: Influence maximization, Weighted network, Weighted Improved NCVoteRank

88- Hybrid AI-Based Scalable Framework for BigData Analytics Using Deep Learning and Optimization Techniques

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Abstract

As a result of the vast quantities of data generated by different sources such as Internet of Things (IoT), health care systems and social media, the term Big Data has come about. Traditional approaches of data analytics are not adequate to handle the scale, complexity and diversity of this data. The authors propose a hybrid framework for Artificial Intelligence (AI) systems, consisting of deep learning-based models and optimization techniques, to enhance the scalability, accuracy, and real-time analytics of AI systems. The proposed system adopts the distributed computing system such as Apache Spark to handle big datasets effectively. The hybrid model consists of deep learning to extract features and predictive analytics and Genetic Algorithm (GA) to optimize hyperparameters. Experimentation has shown better performance in terms of accuracy, computational efficiency and scalability than traditional methods. The framework can be applied to real world areas such as smart healthcare, IoT systems.

Keywords: Big Data, Healthcare Analytics, Artificial Intelligence, Distributed Computing, IoT

02- An Ensemble Model for Facial Expression Recognition using MobileNet V2

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Abstract

In computer vision, Facial Expression Recognition (FER) plays an important role, aiming to understand human emotions through facial signs. This paper presents a real-time, browser-based FER system that leverages an ensemble of Face-API.js and MobileNetV2. The proposed model says key challenges such as lighting variation, pose differences, and background noise. By operating entirely within a web environment using TensorFlow.js, the system ensures user privacy and faster performance. It accurately detects seven emotions—Happy, Sad, Angry, Surprised, Fearful, Disgusted, and Neutral—along with age and gender detection. The model supports multi-face detection and offers applications in fields like mental health monitoring, education, customer feedback analysis, gaming, and video conferencing and many more.

Keywords: Facial Expression Recognition, MobileNet V2, Ensemble, Face-API, Classification.

25- Latent-Space Image Generation Using Hybrid Autoencoder and Quantum Generative Adversarial Network

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Abstract

Image generation is a key objective in artificial intelligence, but old methods such as Generative Adversarial Networks (GANs) and Autoencoders can be really slow and need a lot of computer power. Sometimes they get stuck or do not work properly. To make this better we made a way of generating images that uses both regular computers and quantum computers. We combined a kind of autoencoder with a Quantum Generative Adversarial Network (QGAN) to make a hybrid system that is faster and more stable. Image generation, with this system is what we are focusing on. Quantum Generative Adversarial Networks or QGANs are a part of this. The autoencoder compresses MNIST handwritten digit images into a low-dimensional latent space, reducing the complexity of the generative task, while a quantum generator implemented using parameterized quantum circuits learns to model the latent distribution. A classical discriminator is used for stable adversarial training. Experimental results show stable learning behavior, good sample diversity with conditional accuracy 0.80, mode coverage of 9 out of 10 digits, a quantum latent entropy of 4.12, an Inception Score of 7.91 ± 0.16 , and a discriminator accuracy of 0.7078. Although the FID score of 157.27 reflects current limitations of NISQ-era quantum devices, the results demonstrate the potential of hybrid quantum–classical systems for efficient image generation.

Keywords: Image Generation · Autoencoder · Quantum GAN (QGAN) · Parametrized Quantum Circuits · MNIST · Hybrid Quantum–Classical Computing

Innovations in Intelligent Computing and Communications

Mrutyunjaya Panda, Harekrishna Misra,
Margarita N. Favorskaya, Anna Esposito *Editors*

Abstract Proceedings of the 2nd International Conference on Innovations in Intelligent Computing and Communications (ICIICC 2026) with a special theme: Role of AI in Medical Healthcare and Diagnostics held in Utkal University, Bhubaneswar, Odisha, India from August 12-14, 2026

This abstract book highlights recent research on Intelligent Computing and Communication highlighting its various innovative applications in information and communication technologies. The conference with special theme on "Role of AI in Medical Healthcare and Diagnostics" deliberated on the trans-formative potential of AI in global health with a focus to explore how AI can be leveraged to strengthen modern healthcare and diagnostic systems. Presentations were delivered by healthcare and AI experts on AI from Australia, USA, New Zealand, Finland, Jordan, France and India. The event provided a platform for experts from industry, academia and research scholars to discuss how AI can be harnessed to improve healthcare delivery, disease surveillance, and future medical research.

Discussions resonated around AI health-related research, responsible AI integration, advocacy for AI-related policies, and challenges such as data privacy and the need for robust governance frameworks. This book has divided into three parts where in PART I: Artificial Intelligence for Medical Diagnostics, in PART II -AI in Future Healthcare and in PART III- advances of AI in Intelligent Computing and Communications applications

The full book slated to be published in Advances in Computer Science Applications and Research (ACSAR) Series, Springer as a post conference proceedings will be a valuable reference guide for all researchers, students and practitioners in the field of AI applications in future digital and precision healthcare.

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